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Third Conference on Educational Measurements

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THIRD ANNUAL CONFERENCE

ON

EDUCATIONAL MEASUREMENTS

Held at Indiana University, Bloomington, Indiana,
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"The school survey is a new and distinctive implement of progress. It has come into being for the purpose of educating the public about their schools, and its distinctive function should be preserved. It is a part of our national self-examination. It is the product of civic intelligence and community progress.

"Its object is to make the entire school system pass in review before the public eye. It makes the schools and the public pay attention to each other. It presents the past, the present, and the possible. It is a community stocktaking inventory, and appraisal of its educational assets and opportunities. It aims to place before the citizens a picture of their schools; a picture so accurate that it cannot mislead; so simple that it cannot be misunderstood, and so significant that it cannot be disregarded. It does not always succeed in its aim, but it cannot even take aim in secret or in the dark."—L. P. Ayres, in *Proceedings of Indiana University Conference on Educational Measurements*, 1915.

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Foreword

THE third annual conference on educational measurements at Indiana University has continued in part the lines of discussion inaugurated in the first two conferences relative to the measurement of achievement in certain school subjects. Dr. Thorndike's discussions and demonstrations of the measurement of reading ability at the first conference stimulated investigation along this line by the Bureau of Research, under Dr. Melvin E. Haggerty's direction, the report of which is now being published by the University.

The study on the measurement of arithmetical abilities, published early in 1915 by Dr. Haggerty, and the discussions by Mr. Courtis at the second conference have stimulated further measurement and experimentation in arithmetic during the year, the results of which are now in press.

Coöperative investigations were reported at the third conference by Associate Professor Hubert G. Childs on the cost of instruction in Indiana high schools, measurement of achievement in algebra, acceleration and retardation in certain Indiana high schools, and failures in high schools by years and subjects.

An investigation of handwriting has been undertaken by Professor William W. Black and formed the topic for a preliminary report at the conference.

An important feature of the conference was a practical demonstration in the administration of tests in the Bloomington schools under the direction of members of the faculty of the University School of Education. Such tests were conducted in algebra, arithmetic, English composition, and reading. The test papers were scored by those visiting the demonstrations, and the results were tabulated and interpreted in their presence immediately following the demonstration.

The addresses and discussions conducted by Doctors Cubberley and Buckingham were centered around the general topics of the significance of educational measurements in school administration and the construction and application of standard scales of measurement in school subjects.

Before adjournment the conference expressed its appreciation of the service rendered by the University in promoting these conferences, and requested that they be continued.

Introductory Address

William Lowe Bryan, President of Indiana University

When new ideas are presented, the most important thing is not to agree with them, or to oppose them, but to understand them. Every new movement in education in America is likely to represent some fundamental idea, but every such movement is met by the opposition of those who do not understand it, and is advocated on all sides by those who do not understand it. Every new educational movement is, therefore, on the surface a superficial fad. Thousands of people are crying it up and declaring that now at last we have solved the problem of education, when, in fact, they have no real grasp of the movement which they favor. On the other hand, every such movement is opposed by men who feel affronted because something has come up in which they play no part. If one looks only at the surface, the history of American education is a history of summer cyclones blowing about full of noise and dust until presently they disappear. In truth, however, each of these movements arises because some persons have seen deeply a certain need and a certain way of bettering existing conditions. My appeal to young people who have entered the field of education is not that they shall favor and not that they shall oppose current educational movements, but that they shall strive earnestly to be of those who comprehend the deeper currents of our educational life.

The Significance of Educational Measurements

Ellwood P. Cubberley, Professor of Education, Leland Stanford Junior University

It is indeed a pleasure to me to come back to the old University, tho it doesn't seem quite like the old place. In my day we had a few students and a few buildings and much faith and enthusiasm. Now I understand you have many students, many buildings, and many times the amount of faith and hope and enthusiasm that they had in the days when I was a young man here. It is an especial pleasure to come back and find some of my old friends still here.

I feel somewhat diffident in coming to this institution, however, to talk to you on the question of educational measurements and the significance of the movement. In an institution which has done so much in the line of congresses on educational measurements, and where so many publications have been issued which set forth the work and the value and the significance of it all, I feel a little as tho I were carrying coals to Newcastle in coming to talk to you on the subject. Yet, if you will permit me, I should like to gather up what seems to me to be some of the more significant features of this new movement and present them to you this evening.

I say a new movement. It is essentially a new one. A decade will practically measure almost all the work which has been done in the line of school tests, the formulation of standards of measurement, and the attempt to evolve units of accomplishment. A decade hence I think no school man who assumes to be an expert in administration can expect to have any hearing in the educational world unless he is quite familiar with the work of testing, and with the units of accomplishment which will, by that time, have been formulated. He must also be able to apply such tests and standards in the school system in which he is trying to render service.

I say the movement is new. It is as yet in its infancy. We hardly realize ourselves, I think, we who have been most interested in this testing work, the vast significance of this movement for our profession. It means the making of a profession of school administration, instead of the mere job of running a school system. It means the dignifying of our calling; it means the placing of the profession on a scientific basis; and the far-reaching significance of that can scarcely be overestimated. We are now attempting to do in school work what has been done for some time in the business world.

Any business man who is managing a business in which he expects to make profits will have standards from which he will work. He will have measuring sticks to test the efficiency of his output; he will have units of accomplishment; he will have cost accounting systems; and he will have standards of many kinds. He will also have a continual system of testing and working over what he is doing, to find out whether what he is doing is the best that can be done with the money he has at hand, and whether the output is as large as he could well produce with the work and the money he has to invest in it.

In the business world the business man is continually facing the question of justifying his work to his stockholders. The stockholders demand profits; they want to know whether the business is being efficiently managed; and if the work is not being efficiently managed, as determined by the percentage of profit on the common stock, they demand that there shall be some reasons given to them why it is not paying, or else that there shall be a change in the management of the enterprise.

In the school business we have a State monopoly, in which there is almost no accounting. We have been very content to compel children to come to the school system, and then outline a course of study for them which we felt to be good, but which very often was based on past conditions rather than on future needs. After giving such instruction to our children, we have been satisfied to test them by means of an examination, and to trust to the growth process to bring out the kind of development we hoped for. It has been very analogous to the old chance and luck farming, where the farmer looked at the moon, guessed at the weather, put in his crops, and prayed to the Lord to help him thru the season. Today he may do all of those things, but in addition he applies to his work some science; he begins to find out various things which he needs to know; and he introduces a number of scientific factors into his work. These have tended to eliminate the luck and chance farming of the past, and to introduce into the work of farming a large amount of scientific efficiency.

A manufacturer will have specifications. He knows what he is trying to do, and he draws up his specifications according to the needs of the market he is trying to meet. He has a careful system of accounting; he knows what it costs to produce each part of his manufactured output; he knows how much of his output is efficiently manufactured, and how much raw material goes to waste or to the dump pile; and he is continually studying methods to try to reduce such waste, and make some new profit out of it. He is continually keeping books on all stages of the process; he is continually testing each phase of the manufacturing as it goes along, and rejecting all unsatisfactory output; and he is continually trying to find means for improving those parts of the manufacturing process which are wasteful or unsatisfactory. His object is to secure a more satisfactory output, so that there will be larger profits for the business. I suppose the automobile business offers us one of the most easily seen analogies, and one that we can appreciate best. In this a thoro system of accounting and testing characterizes all stages of the process of manufacturing. Costs are figured on every item of the manufacturing process; the producer knows how much his leather costs, how much his bodies are costing; how much his castings are costing; how much bearings are costing; and so on for every phase of the manufacturing process. He is also continually studying his market conditions. He is trying to adapt his product to new needs; he is trying to find new markets; he is trying to find in advance what people want; and he is changing his specifications continually to meet the new conditions he is facing. The systematized way in which this business is managed would rather astonish the ordinary school man. What is true of the automobile business is true of almost every other successful large business.

In our school work very often we have nothing of that kind. Our specifications are not always dictated by the needs of the future; too often they are framed by those who are thinking in terms of the past. We have no unit-cost accounting systems; we do not continually measure the output. An age and grade distribution sheet for almost any school system would show a very large amount of waste in the process of manufacture.

In farming, up to a very short time ago, the manufacturing process went along in a very unsatisfactory manner. Some farmers still manage their farms in that way today, but the farmer who is efficient, the farmer who is making his farm pay, is now a farmer who knows what everything on his farm is costing; whether his cows are paying their board and keep; whether the pigs are paying enough in profits to warrant retaining them; whether or not he can raise wheat at a profit when it sells for a dollar a bushel; whether horses are more economical than machinery for certain parts of the farming work; and the amount of saving that can be made on this or that or the other thing that he does on the farm. In fact, a modern farmer has a long series of bookkeeping accounts, and out of such he can tell whether he would better sell any cow to the butcher or keep her; whether he would better quit raising pigs, etc.

To return to the school, we find many new demands, and new conditions facing us. There was a time, a very short time ago, when in most of our cities the city council tended to divide the money derived from taxation rather evenly between the schools on the one hand and the other branches of the city government on the other. That day has passed, and probably passed forever, and we can look forward, as city superintendents of schools, to an increasing struggle in the cities in which we are working to be able to retain for the schools a proper percentage of city funds. Why? Partly because of the increase in cost of everything, with every city finding that it must increase its budget in order to meet these increasing costs; partly, also, because in many of our cities the question of what results are being obtained from the money expended is being faced by all departments, and the school department is one of those which can answer least satisfactorily.

As a recent writer has said, why should New York City, for example, be spending more money on inefficient teachers, rather than on efficient subways? Why should it build more schools instead of doing more for the sanitary conditions of the city? Why should it provide better pay for school janitors, rather than provide for more milk inspectors? Why should it try to do more for children in lines of education, rather than improve the milk supply and save the city's babies?

In almost all the lines of work mentioned it is possible to put before a city council perfectly definite facts; that is, so much money spent upon the protection of the milk supply meant a reduction of so much in the death-rate of children last summer; so much spent upon sanitary conditions meant an equal decrease in the sickness rate and death-rate. The school man almost alone has been without such figures.

Again, the increase in the cost of everything is going to make us look, with greater care, upon our expenditures. Are we spending our money well? Are we not spending much money in unnecessary duplications? Are we not indulging in a large number of very costly luxuries? Are we doing the best we can with the money we have at hand? Now to know those things involves some system of accounting, of a type which we have not as yet introduced, at least to any extent, into our school systems.

Up to a very short time ago our chief method of measuring a school system was the method of personal opinion. You go into the school system of Superintendent Jones and look it over and say it is quite poor; I go in and I say it is quite poor, too. We both agree; therefore it must be poor. On the other hand, I go in and say I don't think it is poor; it has some weak points, to be sure, but I think it is very good. Now it becomes a question of your opinion against mine, and mine against yours, and people will believe whichever side they happen to favor, or whether they know you or know me. Such a method of estimating by personal opinion will never get us very far.

Within the last decade or so we have introduced another method which has much more promise the method of comparison. By this we take the different cities of the same class in size, children in school, wealth, and so on, and compare them upon a dozen or twenty different items. After making such a comparison you say thay a city stands sixteenth out of 20 from the top in this item; it stands seventeenth in this one; in stands twelfth in this item, and so on.

This is very much better than the method of personal opinion, but it is defective in that you are continually comparing with the average of a kind. The average has the defect that you are continually measuring yourself against mediocrity; you are striking the average, or the median, and you are finding out where you are with reference to this average or median, and in a series of, let us say, 20 schools, the average or median may not represent a good system at all. Perhaps all below the average or median are poor, and perhaps even a portion of those above are not doing what they should to be progressing. The real progressive cities are in the upper portion of the group, and it is there that you should measure yourself, rather than by the average of the lot.

The third method, to which we are coming, is a method of setting up standard measurements and units of accomplishment for the measurement of the work of our schools. This whole movement has been evolved very recently. Perhaps a decade, as I said a moment ago, covers it all. We began with writing tests and spelling tests. Then we evolved a composition test. Next we secured arithmetic tests—tests for the fundamentals, and tests for the reasoning side. Then came drawing tests, reading tests, and so on. Today tests in almost all of our elementary and in many of our high school subjects are being evolved.

In addition to these we are beginning to get standards for measuring teaching efficiency. We are also getting a reliable scale for measuring the intelligence of children. We are getting very good measures of retardation; we are beginning to set up standards of the usefulness of the school subjects which we are teaching; and we are beginning to get standards for cost accounting, not only for subjects, but for schools, buildings, fuel, janitor service, etc.

In other words, we are beginning to measure not only the output of our factory, but the cost of the output as well. In the evolution of those standards we are, I think, making progress along the lines which the business man has found so useful and so efficient. We are also beginning not only to get tests by means of which we can go in and test up and see where a school stands, but we are beginning to evolve some units of accomplishment, and units of accomplishment naturally come as a corollary to the tests themselves. By tabulating the results from a large number of school systems we begin to find out what is about the average for a school system. By applying the tests to people in life outside we try to find the needs of common life in terms of these tests, and out of such study to evolve in time a series of units of accomplishment,—a series of standards for work of the different grades which will enable us to say that we have done, or that we have not done, what might reasonably be expected of us for the children in the eighth grade, or the seventh grade, or the sixth grade, or wherever we may desire to question school accomplishments.

For example, in spelling we have now evolved rather reasonable and fair standards by which to measure a school system, and now we are in turn beginning to evolve better spelling books, worked out on a much more rational basis. Many of our spelling books have run as high as 8,000 to 10,000 words, whereas we are finding we don't need any such number at all, and that perhaps 3,000 or 3,500 words would be sufficient to teach the children in all of their eight years of the elementary school courses.

A series of spelling studies has been made in various parts of the country, and these have been tabulated recently. A series of investigations has been made of business men's letters; a series of investigations has been made of the letters which farmers write to the agricultural colleges, and various other types of spelling investigations have been made, and when all have been compiled and put together, the surprising thing is that the number of words which occur two times or three times is relatively small—less than 4,000 in all—and those approximately 4,000 are now being compiled into a spelling book which will represent what we might call the maximum for the work of our elementary schools.

Again, in writing, thru the Ayers and Thorndike scales we have evolved something of a standard of what a child ought to do. We feel fairly well satisfied that a child of the fifth grade ought to be somewhere between 11 and 12; in the sixth, somewhere near 12½ or 13; and so on with the different grades, and the children can measure their own writing by such scales if they wish to do so.

In arithmetic also we are beginning to get some standards of accuracy and some standards for speed. In a recent investigation, published in the last "Yearbook of the National Society for the Study of Education", Mr. Courtis tells of a small investigation which he made with a number of clerks in the Wanamaker store in New York. He was trying to find out what was the standard of accuracy demanded by the work in the Wanamaker store. After we have greatly multiplied such investigations, and have combined the results, we can begin to say what are the standards of actual business life which we in the schools ought to be meeting.

Now perhaps I can best point out to you the significance of all of this by telling you a rather interesting story of the schools of Salt Lake City. I was recently asked to direct the work of a school survey there. One of the actuating motives for that survey was the persistent complaint of the business men of Salt Lake City that the children could not write; that they could not spell; that they could not cipher; that they could not read; and that they could not compose. That complaint had been so persistent and had been made for so long that the schools had gradually come to emphasize reading and writing and composition and arithmetic out of all proportion to their relative merits. The time allowed for all of those subjects had been gradually pushed up, more words had been put in to be spelled, more problems to be solved, and more composition work to be done. As a result, when the schools were measured and compared with other cities in the United States, Salt Lake City stood nearly at the top. Their spelling allowance of time was running 125 to 150 minutes a week, whereas 75 minutes is regarded as ample; they were doing a grade of spelling and on a type of words for which there is no real demand; their writing was excellent. In reproducing the median writing samples in the Report we said that the business man was respectfully requested to put a sample of his own writing by the side of the median sample for the seventh and eighth grades, and see where his own writing stood. In arithmetic they were doing good work; in reasoning they were very good; in composition they were good. In other words, the school, in response to persistent complaint from the business man, was entirely overdoing the so-called fundamentals. They were doing more than there was any reasonable right to expect the schools to do, and children were attaining an efficiency which business life probably does not demand.

The studies which have been made on retardation, which began earlier than those with the school tests, have shown us that every school system is guilty of a large waste in production, because many children are hopelessly mired down in the grades with almost no hope of ever making progress. They are discouraged and see little chance of ever amounting to anything, because the school is trying to put everybody thru the same kind of a process. Instead of adopting the business man's method, and employing a number of specialized pieces of machinery and specializing phases of the manufacturing process, we are using one type of machinery and trying to put everybody along the same line, instead of developing different types of schools and different types of teachers to meet the different types of requirements which are presented by the overaged, the non-English speaking, those of low mentality, the troublesome cases in discipline, and those of various kinds of peculiar ability which we meet with continually in our schools.

In the matter of costs, also, we are beginning to get some units which are of value. Why should a classroom in one city cost $8,000 to erect against $4,000 in another? Why should it cost four times as much to heat a classroom in one building as it does in another? It may be perfectly explainable, but it is something that should be looked into. If we find Greek, for example, in our high schools is costing us, let us say, $300 for 1,000 student hours, and the other subjects of the high school are all costing less than $100, might it not be a legitimate question as to whether or not we should keep on teaching Greek, unless we can do it in a more economical way? And so I might go on enumerating large numbers of other cost phases of the cost problem.

We might find, for example, that the cost for supplies in the school system averages 64 cents; that in one-third of the buildings it was over 90 cents; in another third of the buildings it was less than 20 cents. A very legitimate question would be whether or not we are providing too many supplies on the one hand, and whether or not we are not inadequately supplying those building which are costing us less than 30 cents. Ought there not to be a speeding up of those schools in the matter of expenditure; especially would this be the case should we find that that low expenditure is correlated with a high retardation?

During the past ten years a large number of statistical studies has been made; they are so numerous that one can scarcely keep track of them. As a result, we have accumulated a lot of medians, graphs, and a lot of statistical data. Sometimes, when I read reports of superintendents, it seems to me that they have done little more than accumulate graphs and medians and statistical data. In themselves those things amount to little or nothing; it is the interpretation we give of them that is the valuable thing. What we want continually is to interpret the results of these studies. What do your graphs mean? Where is your median compared with what it should be? What do your statistical tables show you as to needed changes? Do they indicate that you are making substantial progress, or not? Do they indicate that too many things are being done, or too few? Do they indicate that you need additions, or eliminations? Do they indicate that progress is being made, or that you are slipping backward? What change in procedure—in the process of manufacture—should you make? What further specialization in the process of production should be effected? What possible economies can you make in your school system? That is, it becomes practically the business of the superintendent to become the superintendent of a business. In a sense his business is the business of manufacturing as good brain power and as high a degree of intelligence as is possible with the money which he has at hand. Of course, I am keenly aware that there are two sides to school work. There is one purely objective side, which we may test and measure; there is another side that is subjective, that is personal, that is inspirational, which we can't test in any such way. Still I have a very deep feeling that the school system which is doing the objective things well is probably looking after the subjective things in a good manner also, and that the school system which is doing the objective things unintelligently, overdoing them or underdoing them and not knowing why, is probably not doing the subjective things so well as they might be done.

As I said, the superintendent of schools needs to become the superintendent of a business. In altogether too many school systems what we need is a speeding up of the whole educational process. What we need is the introduction of a large number of new pieces of specialized machinery in order that we may specialize the production to meet a large variety of markets. There isn't just one market to meet. The people of a city spending, let us say, $2,000,000 or $3,000,000 on their schools are the stockholders of a large enterprise, and the superintendent of schools is the manager of the business. It should be a very large part of his business, and it should be a very large part of the business of the stockholders as well, to see that it is his business to interpret to the community the progress, the successes, the failures, and the lines of improvement of the business undertaking which he is directing.

Now what is the significance of all of this movement to three different classes of people: first, the teacher; second, the citizen; and third, the superintendent of schools?

To the teacher it seems to me this new movement means a very large amount in the future in peace and contentment and personal satisfaction with her work. It means concise and definite statements—eventually; perhaps not soon, or perhaps not at once—but it eventually means precise and definite statements as to what the teacher is expected to do along the purely objective lines. Along the purely subjective lines, such as inspiring a love for literature, developing patriotism, and awakening high ideals and ambitions, we can't of course measure things in this way, but along the definitely objective things of the school we can lay down irreducible minima, and we can also lay down maxima beyond which the school system will not be expected to go.

The investigations recently made in Boston are illustrative. They have found in English, for example, that these things need to be insisted upon: that a student should be able to copy prose from dictation, and copy it accurately; that the student should be able to copy accurately, from a copy placed in front of him (or her), a bill containing a dozen items; that the student should be able to write a satisfactory letter of application for a position; that he should be able to write a simple composition, upon some simple subject of his own choosing, and write it with proper punctuation, paragraphing, and capitalization; that the common errors of the common parts of speech, especially those of the verb "to be" and a few other common verbs, should be eradicated; that the student should know the common parts of speech, and be able to recognize them in sentences; that the student should be able to stand and read intelligently simple prose, so as to carry meaning and conviction to those who are listening; that the student should have learned and be able to quote at least fifty lines of good classical prose or poetry; and that the student should be able to stand upon his feet before the class and make an oral presentation of some subject which he has looked up and is interested in. If the students finishing the eighth grade can do those things, they say—that is, if all of the preceding teaching of English has by the end of the eighth grade reached that standard of usefulness by means of which a child can do those things—that these should answer for the needs of life and for the needs of the business world. Whether or not that is a final standard, even for Boston, we may seriously question. Whether it is the one we should accept generally may also be seriously questioned. It is, however, an earnest attempt on the part of a single school system to work out, for its own needs, some definitions of units of accomplishment and maxima that may be insisted upon in the teaching of a single subject.

They are also trying in Boston to find out what useless knowledge is being taught. They are finding, for example, that quite a large amount of the geography taught is of no real value. It does not interpret anything to the child; it is soon forgotten; and it is of no particular value. Again, what is the use of teaching a large number of arithmetical processes which we shall never use? I should like to ask you, outside of your business as teachers, how many of you, in the last ten years, have had use for any arithmetical processes other than addition, subtraction, multiplication, division, simple and decimal fractions, and a little interest and percentage? You have had very little.

As we begin to develop units of accomplishment we also help the teacher in that we can give to the children some standards by which they may test their own work. Just as children in city systems where writing scales are hung up in the classrooms are continually going up and testing their own writing, so they may be able to do in time with other subjects in the curriculum which are capable of objective measurement. If a child in a city school system says that he has achieved standard 11-A on a Thorndike writing scale, and, if we know what a Thorndike writing scale is we know exactly how well the child can write. If, however, he tells us that he received 93 per cent in his report last term, what idea have we as to how well he can write? The statement would mean nothing because it is not expressed in any generally recognized standard. So, for the teacher, the movement promises to offer standards which she may use with her pupils, and say that whenever a pupil comes up to standard 12, or some other unit of accomplishment, the pupil may then decrease the time spent on the subject and go on to other work.

It will mean, too, an ultimate differentiation of training for the different pupils which teachers now have, and the specialization of production with our children, which will be worth very much in education.

Again, standards for school work will be worth much to the teacher in the line of vocational guidance. Superintendent Bliss, of Montclair, N.J., reproduced, in the last "Yearbook of the National Society for the Study of Education", diagrams along this line, for a child who was found to be somewhat feeble-minded, for his work in writing and in arithmetic. There was no possibility of training that boy ever to reach any good standard in arithmetic, and it was foolish to try to do so. He should be trained in the things he could do; trained to make himself as self-respecting as possible, and able to care for himself. If he never reaches higher than the mental standard for a twelve-year-old child, he still will have some ideals of self-respect, some desire to do whatever he does do well, and the ability to go out into life and earn his own living, take care of himself, and not be a burden upon society.

From the standpoint of the citizen, the whole school standard movement means the erecting of standards by which he can estimate the efficiency of a school system. In a book which I published recently, "Public School Administration", I drew an analogy, in one of the chapters, between a board of education and what it tries to do, and a board for hospital control and what it tries to do. I took a school board of 12 men and divided them up into committees which were perfectly descriptive of present city school conditions. Then I conceived that this same board of 12 men had been elected, not to manage a school system, but to manage a municipal hospital, and then divided them up analogous to hospital committees. The committee on kindergarten was replaced by one on the maternity ward; the one on supplies by one on drugs and instruments; and so on down thru the list. I now conceived that these committees proceeded to manage the hospital, and to assume over the superintendent of the hospital and the nurses the same degree of authority which similar committees now exercise over the superintendent of schools and the principals and teachers. I leave you to imagine the result.

Once we work out objective standards for accomplishment in school work the citizen can be made to understand when there is mismanagement in a school system, as he now can understand it in other lines of public control. He has had up to now, however, no standards by which he could tell whether a board of education is outrageously mismanaging a school system, or whether a superintendent is of any value whatever or not fit for his job. If the superintendent of schools goes to church regularly, is a "nice fellow", speaks well of everyone, is very cautious and keeps out of trouble, and when he meets a mother with a child says, "Now, that *is* a baby",—he has too often in the past been able to get along very well and hold his place for years and years, and yet do very poor work in the school system. We have had almost no standards for measuring up his work or evaluating his services. Once erect a series of objective standards by which you can tell, not only when the children in the schools are making progress, but from a cost accounting system when expenditures are well apportioned, and the citizen has something which will be useful to him and will enable him to find out whether or not the school system is giving value received for the taxes which are paid for its support.

From the standpoint of the superintendent, in the third place, the evolution of educational measurements means the changing of education from guess-work to scientific accuracy.

We "guess" that we are not making the progress in arithmetic we should, and in consequence order teachers to add 50 minutes a week to the arithmetic time. We "guess" that we are not making proper progress in spelling, so we add a large number of supplemental words. We "guess" that our writing isn't as good as it ought to be, so we increase the time from 20 to 25 minutes a day. And so we "guess" all along the line. Given definite standards for work, a superintendent can then say to his board and to the people: "Our schools have already reached and passed the standards which are generally recognized by the men of my profession as being the standards which children of such age or grade should attain. Our children are able to do such work, and do not need more drill." He then has something tangible by means of which to defend himself.

It means in turn much larger demands upon the superintendent. It means much better professional training, and I am thoroly convinced that in a decade from now our universities and our colleges of education will be giving a training for school administration of which we scarcely dream today. We are accumulating information so rapidly that one who is a master in his craft will need to be a constant student, just as a good doctor or a lawyer is; he will have to discard politics; he will have to discard favoritism and "pulls" of various kinds; and he will have to come to a scientific study of his work, and be able to stand up and defend his work on the basis of the standards and units of accomplishment which the men of his craft have set up as being those which should be used.

It means the changing, then, of school administration from a little local job, to which we can still elect an old and deserving lawyer, as was done in one of our cities not long ago, or to which we can promote a member of the school board, as was done in another city not long ago, and the transferring of school administration into a national profession, in which the superintendent will be a citizen of the nation engaged in the work of managing schools, just as we today have national characters engaged in managing automobile factories, or steel plants, or railroads, or any other form of large public business. Then he will be selected because of his expert knowledge; he will be held to strict accountability for results in terms of standards; and he will be expected to secure expert results. In other words, he will be transformed from a politician into a social engineer.

It means, I think, the end of the day when a book man or a contractor who doesn't like a superintendent can come into town and "get his scalp", because the superintendent will be able to defend himself in terms of the standards which are recognized in his profession. It will also mean that school superintendents will be subjected much less to the whims and local foolishness to which superintendents in this country are now too often subjected.

Round Table: Standard Tests in the Work of School Administration

LED BY ELLWOOD P. CUBBERLEY

As I said last evening, what we are trying to evolve is a series of objective measurements for the perfectly measurable things in our school systems. As I also said last evening, it seems to me that in the near future not only superintendents of schools, but principals of schools as well, will be expected to use scientific measurements—instruments of precision—as means of finding out how effective their work of supervision is.

As I have gone about from place to place on school surveys I have always been struck with the general weakness of the elementary school principal. I remember in one city which I surveyed some 35 teachers had just been dismissed from the school system. After much newspaper criticism the board appointed a committee to go around and investigate the reasons for the dismissals. The committee heard evidence in each of the school buildings, the evidence being taken down by a stenographer. I examined this evidence carefully, and it seemed to me that altogether too many cases indicated that it was the principal who needed to be dropped, rather than the teacher. The charges which he had made against the teacher were charges which showed that he himself was not up to the job of school supervision in the way that he should have been; that he wasn't handling his problem properly; and that he really didn't know what was going on or not going on in his schoolrooms. He was handing out chalk, keeping the keys, looking after the textbooks, making up statistics and time schedules and things of that type, and doing the easy work, but so far as helpful supervision to the teachers of his building was concerned he wasn't giving such at all.

As I said last evening, we have now evolved tests which are perfectly definite for a good many of our school subjects. For example, in writing it is now very easy to see at what point in a scale a pupil or class is writing. Some of our school systems have made up writing scales of their own, following Ayers or

Thorndike standards, but made up from the work of pupils in their own schools. These may be just as useful as the standard scales, and may stimulate more interest. Some of our schools, too, are in the process of evolving composition scales which are improvements over either the Hillegas or Harvard-Newton scale. We might go on and enumerate other subjects in which school systems are evolving their own scale standards for the judging of the quality of work done by the teacher in the classroom. These show the teacher where she needs to put further emphasis, where things need to be done or where they don't need to be done, and they reveal to the teachers that their teaching is effective or that it isn't effective, or that it is somewhere in between.

Now, as I understood it, this morning was to be a round-table discussion, and I wasn't to do much of the talking. It seems to me that perhaps I could do best, after having made this preliminary statement, if I called on some of you to tell, very briefly, how you are using the standard tests for the purpose of checking up your supervision. In other words, how are you using them as a means of supervision if you are a superintendent, as a principal if you are a principal in a school? How are you using them in order to check up the teaching in your schoolrooms, and what are the results which you are obtaining? I don't mean statistical results. I mean brief general results—what you are getting, what they are showing you, and what your teachers are getting out of it all.

May I not first ask for some volunteers who will tell, in two or three minutes, what they are finding out, and how they are using the tests? The floor is open to anyone. I am at somewhat of a disadvantage in not knowing you, otherwise I would call your names. I see my old friend, Mr. Weir, in the audience. He is, I believe, a supervising principal in Indianapolis. May I not ask him to tell us, briefly, what use he has made of these tests in school supervision?

MR. WEIR: I will say it is a little unfortunate for me to be present. Dr. Cubberley, having known me as a boy, thinks I should know something about supervision of schools as a man. Well, in Indianapolis we have a special system of supervision of schools, a supervising system, perhaps, that is different from many systems thruout the country, there being eighteen supervising principals for the various schools. We are of course keeping in touch with the various measurements which are being made—various systems of measurements—and working somewhat in connection with them.

However, we have not tried out many of these systems of measurements. At the present time we are giving the Courtis tests—the first systematic work we have done as supervising principals. Many of us have attempted some systems of measurements for ourselves. In my own schools I have used the Thorndike test in writing, and have found it effective in just the way in which you mentioned, the children making their own comparisons. It has been very interesting to watch them making the comparisons of their own penmanship with the Thorndike scale. Other than that I have not done work in my school along those lines.

MR. MYERS (of Bloomington): I might say that this is my first year in connection with the Bloomington schools, and quite a little of the work that has been done before by my predecessor has been followed out by the teachers who are now in the corps. The Ayers scale has been used a great deal in assisting pupils to get some standard of their own work in writing, and a great many of the tests that have been carried on by the School of Education of the University have been carried on in the Bloomington schools. The results of these have been seen; weak points have been found out; and the teachers have endeavored to improve where the tests showed weaknesses.

Now, to get the specific part of that, I think, Professor Cubberley, if Miss Kerr, the principal of the Departmental Building, is present, she could give a number of these things more in detail than I could, and I should be pleased to yield the floor to her, altho she hasn't known I am intending to do this.

MR. CUBBERLEY: Will Miss Kerr be kind enough to tell us of her experience?

MISS KERR: Our work in the Departmental School in Bloomington, consisting of sixth, seventh, and eighth grades, has been chiefly for the last few years on the Courtis tests. We have used the Courtis tests as a means of finding out where we were, in the first place, and then, after having studied our results as carefully as we were able, to determine upon some procedure to remedy the defects as we found them. Last year, for instance, we gave the Courtis tests along in February. We found that our particular weakness was in addition. We decided upon a systematic drill in addition to remedy the defect, if possible. We worked on that for 6 weeks, giving 5 minutes a day.

Exactly the same method was used in all classes with all children. We gave the Courtis test again at the end of the sixth week to determine whether or not we had got the thing we had worked for. We found, when we measured our school with it, that we had made great progress. When we measured our school, or compared our school, with the twenty Indiana cities upon which Dr. Melvin E. Haggerty based his report in the University "Bulletin" last year, we found that no school system in Indiana came anywhere near what we could do in addition.

I gave a preliminary report on this study last summer to one of Dr. Haggerty's classes. I was asked at that time if this thing was permanent; would it hold? We didn't know then whether it would or not, but we gave the Courtis test again as soon as school opened in the fall to see whether this held. We found that we had 294 children then in the department who had taken the two previous tests and who had had the 6 weeks' drill. We found that, taking the median for the 294 children, irrespective of grades, and throwing them in one large distribution, the children had maintained a gain of one whole example in addition, showing, I think very conclusively, that the drill for at least $66\frac{2}{3}$ per cent of the children had had a permanent effect.

You might wonder whether they had also made any gain in subtraction, multiplication, and division. They had made none. They were practically where they were, and in some cases had dropped back. But we feel that, for at least two-thirds of the children, we have given them something permanent.

That is the use we have made of the Courtis tests—attempting to find out where our defects are, and using some remedial agency.

MR. CUBBERLEY: May I ask you to tell what effect the use of these had on your teachers? How did they take them, and what were the results from a supervisor's point of view?

MISS KERR: That is the best thing, I think, that came out of it; the fact that these teachers have been shown conclusively thru their own work—they did the scoring, by the way, they did the major part of the work. This is the thing that has been emphasized for them, the biggest thing—the individual differences in these children. I think they worked with their children more intelligently because they do know that sitting before them here may be a group of 30 eighth-grade children, no two of whom are alike, and, because they have learned this thing thru this objective work which they did with the children, they can be more patient with, and work more intelligently with, the capability that each child brings to the class.

Mr. Cubberley: You have brought out a very good point.

Mr. Myers: In the work that Professor Haggerty presented last evening I was very much interested in the school number of Bloomington; there were 2 or 3 places that it was above the median line, very distinctly; there were 1 or 2 places that were below the median line. Now we will be very much interested in seeing what can be done to remedy that defect as shown by that study. I just wanted to mention that. That is the way we try to use the tests.

Mr. Cubberley: That is a good point to bring out. We discover as a result of our work that certain things run above, certain things are much below median. Then you have reason for bringing up some, and perhaps for stopping your emphasis on other points; that is, you have brought the work up enough there, so stop and put your emphasis on some other side.

Mr. Horton, of Mishawaka, I understand, has done some work of which we should like to have him tell us.

Mr. Horton: I have done my work not as superintendent of schools at Mishawaka, but as principal of the high school. I want to speak first as chairman of the Research Committee of the Northern Indiana State Teachers' Association. Now we have been determining the policy of research which we think will best meet the needs of the high schools of the State, and Professor Childs has been kind enough to work out the different studies we thought would benefit the high schools. This year we determined to study unit costs, and to take up some one phase of that. There had also been some preliminary work done on supervised study.

The results of the unit-cost test, the preliminary results at least, you have seen, and we expect to continue that study. The algebra tests we expect to continue, and to try to perfect a test that all of the high schools can use, and to arrive at some standards in that.

Now as to the supervised study, only about 3 or 4 schools could experiment on that. We have been experimenting on it, and we started in with a 60-minute period. The recitation was to take place in the first 30 minutes; in the last 30 minutes the time was given to supervised study. The recitation was to end somewhere within the first 30 minutes. Then we have been keeping figures on the efficiency of study for say 5-minute units, and on the fatigue curve of students for the study, and on their efficiency for study at different times of the day, and so forth. Then we have been keeping comparative results of our supervised study, as contrasted with the study under the old plan. We have some definite figures on that line. Those were presented at the high school section of the Northern Indiana State Teachers' Association in Chicago.

Now as to tests in the high school. I have been experimenting with some tests with the idea of furthering the work of this research committee. One thing we have in mind, I think, that is very liable to have tremendous results on the high school work, is to get together the groups of men in the high schools in different States that have been doing this kind of work. That is, there is a group of men in Illinois that have been doing work on tests, and there is a group of men in Iowa, and there is a group of men in Wisconsin, and there is a group of men in Indiana, and we have been trying to get the work of these different groups of men together, so that when we work out a standard test, or a certain line of investigation, that that can be used thruout the North Central schools, so that we will see where we stand and where all of the schools stand in relation to that.

Mr. Cubberley: Will you not tell us briefly how you have used this in supervision, which is our main point this morning; how you have used this in the supervision of your teachers?

Mr. Horton: In the supervision of my teachers I have the normal curve of the distribution of ability for our grades. I have had that for the last three years. I think that has accomplished wonderful results. We apply that to our grading system; we have it also; and we use the normal curve of the distribution of ability. Then I have the teachers make reports of how their class stands under that normal curve of distribution as it has been threshed out on the screen two or three times. That has been a wonderful thing in standardizing our grading. That is, it makes an *A* mean a certain thing, a certain standing in the class, so that the grades of the students mean a very definite thing. A teacher can't skew that to, at least, any large amount.

Then we have used the reading tests. We used the Thorndike reading tests on a group of students that we thought were rather behind their grade, and it showed definitely that they were behind the standard of the Thorndike reading test. We are going to use the Kelly reading tests, too, and try those out on the same section.

Our Latin department is going to use the vocabulary tests. We are just investigating a copy of the Latin and German vocabulary tests at the present time, but we are going to secure those for use in our classes, and try them out.

We are starting on a line of investigation in relation to our high school penmanship. The study here yesterday showed that the quality of high school penmanship falls down; the speed increases, but the quality falls down. Now we are going to use the Ayers scale for adult penmanship, and we are going to try to establish a standard for our written work, and I am going to give each teacher a copy of that Ayers scale so that we can keep our writing up to a certain standard. We are also experimenting with supervised study with the algebra tests. Of course we were in on the unit costs, and we will use those, of course, for the administration and supervision of schools the same as the other schools have used them.

MR. CUBBERLEY: Mr. Neighbors, of Wabash.

MR. NEIGHBORS: I am not a person who has done a great deal of work with the tests, altho I have done some experimental work in other lines.

MR. CUBBERLEY: Tell how you have used them with the teachers.

MR. NEIGHBORS: I haven't used them myself, but my predecessor, who left Wabash about two months ago, did. I couldn't tell how he used them, but the conclusions have been that these tests emphasized more or less certain danger signals, or set up certain guide posts. You can't always draw certain definite conclusions after having given tests, but you can always tell that here is a condition which needs investigation, and I know that that at least was his policy, and, from the little experience I have had, has been mine.

Mr. Horton suggested one thing I should like to mention, altho it may be just a little off the subject. It emphasizes the general idea. In the matter of the curve of distribution of grades, we had some occasion to make some experiments several years ago and we found that our curve was decidedly skewed in favor of the eighth grade, a grade which happened to mark the particular point of exemption in our high school in this year. We did away with the whole exemption system, and at the end of the first term I made another curve of distribution for the grades in the high school, and found that that curve behaved in a perfectly normal way, with no skewing at all in favor of the eighth grade, which might argue that the teachers had been somewhat influenced by the fact that, when they got near to the decision point, not knowing exactly what to do,. they gave the pupil the benefit of the doubt and skewed the curve in favor of the exemption grade. It meant for us at that time that, if this curve was skewed in the direction of that particular grade, this was the cause of it, and it seems to me that is the whole point of tests of this sort. Here is something that needs investigating, and let's see what the cause is.

Mr. Cubberley: Has someone else some contribution to make?

Mr. Giles (of Richmond): Mr. Chairman, most of us do not have a single officer in the force who can give the test thruout the system, and if we do not have that difficulty, one of the biggest difficulties then is to get the test given under uniform conditions. For instance, in giving the spelling test it was given by the principals of our buildings, and whereas our median was along about 70, where it ought to be in most buildings, in one building the median was up in 90, and that was the building that had the lowest median in every other test that we gave. Now that meant something was wrong, you see. There is a very great temptation to get ahead of the game, somehow.

The remedy that we have at Richmond for that you may not all be able to use. We have all of our pupils in a junior high school, and in giving the Courtis test a few weeks ago we gave it simply to the seventh and eighth grade pupils. It was given by the teachers in the junior high school, and instead of simply writing on their papers the "Garfield school", they wrote the school that they came from, and I used it as a check on the supervision of our ward schools for the first six grades in arithmetic. You see there couldn't be any objection to that. It was turned over to the principals to find out why their score happened to be low or high. Now just one other point.

We are using the Jones vocabulary list in primary reading. The principals are, together with the kindergarten teachers, giving that in the primary grades, the 1-A, 2-B, 2-A, and 3-B. The purpose of that is to test out our method of reading. We have a variety of methods. Some teachers are using pretty largely the Ward; some the Rockford and the reading literature; some the Aldine; some the Beatty. There are quite a variety of methods being used by our primary teachers, and we are giving this Jones vocabulary test in order to get some check, if possible, on our methods of primary reading.

Mr. Cubberley: Mr. Childs.

Mr. Childs (of Indiana University): I wish to make one statement. I suppose there are in Indiana, in spite of the fact that Indiana has excellent superintendents in this movement, a few possibly who test just for the sake of testing, but they soon quit that because there is too much work connected with it.

Within the last four weeks I have had four or five requests from principals and superintendents out in the State, writing in here for data that we have collected in some of these studies, stating definitely that they wished them for the purpose of bringing about certain reorganizations in their work on which they felt that information would be valuable. I am glad some of the superintendents and principals are finding some value in some of these things, and are making use of them.

Mr. Cubberley: I think the contributions which have been made so far indicate rather clearly how we may use these tests. There are many ways. Perhaps I might close this discussion by telling you some that I have come in contact with myself, which will also reveal usefulnesses somewhat along the line of those which have been mentioned.

One of the most interesting studies, I think, that I have ever been engaged in was the survey of the school system of Butte, Mont. There may be less promising places in the United States than Butte, but I have never seen them. Something like 80,000 people are collected there on the hillsides; the whole town undermined with copper shafts and tunnels; saloons everywhere; everything run as a wide-open town. It is a place where almost nothing green grows, the smelters having killed almost everything. To have lawns the dirt must be brought in from the outside. There are a few bushes and a few trees seven or eight feet high in town, but that is about all. The children know almost nothing of nature, or of proper home life, because the schools were doing almost nothing to teach them these things. There was, at the time we tested the work, no domestic science in the grades, and only a little poor manual training. Everything concentrated on the formal book subjects. The conception of the school seemed to be to get a room, a stove, and a teacher, and have the pupils get their books and come and learn what they contained.

Now you can readily imagine that a school system such as I have described, when tested, would test up rather high along purely formal lines, and would test low along lines which involved reasoning, and that is exactly what we found. All of the evidence from the tests pointed to a school system emphasizing memory work as the chief end of the educative process. The pupils ranked high in spelling; and high in addition, subtraction, multiplication, division; but very low in composition, and in the reasoning tests of arithmetic. The children showed up poorly in all reasoning tests; nothing in the school system emphasized that side. I don't know of a place where tests have been made where the character of the school system tested has stood out so clearly as did the schools of Butte; what was needed there was a radical reorganization of the school system. If the superintendent of schools was hampered by his board of education, then the board of education needed to stop interfering with the schools. If the superintendent was not hampered and could go ahead, then what they manifestly needed was a new superintendent of schools. That that school system needed reorganization from top to bottom was clearly shown.

Turning to Salt Lake City, I can cite another very good example, but of a very different type. The schools there as wholes showed up well in all of the tests, but whenever we began to analyze differences between grades in different buildings we found quite marked extremes. Here was one building which was uniformly high in almost everything; there another building which would run uniformly low in almost everything. The natural question that ought to be asked of the principals is how they could explain such large differences. Wherever we tabulated single rooms or grades we found the differences among the children within the grades were even more marked than the differences between buildings. The report tried to call the attention of the school authorities to this condition, and to say that what the school system had done for the mass it ought to set itself seriously to try to do for individuals,—what the school system had accomplished so well up to now for the average child, it needed to set itself to do for the individual child. For example, in spelling, 40 per cent of the children weren't tested by the test at all. That is, 40 per cent of the children made 100—they spelled everything they were given, and therefore they were not really tested. When we found, in say a sixth-grade room, from 25 to 30 per cent of the children making 100, and perhaps 15 to 20 per cent of the children not coming up to a fourth-grade average, the natural question to the supervisor is, why these differences?

Again, a retardation sheet taken for an entire school system, or for any building in the school system, would show similar results. In the city of Portland, for example, where I directed a survey in 1913, a retardation sheet there showed conditions that were very surprising to the school principals. Statistics published in the annual school report showed that there were over 1,500 children over 15 years of age in the elementary schools. When we asked the building principals to give us an age-and-grade distribution sheet for their building, and we showed them the charted results, many were greatly surprised to find that in some of the best schools and some of the best residential sections of the city the retardation would run 20, 25, and 30 per cent. This illustrates how a retardation sheet may be used as a means of supervision.

The Butte study showed clearly the need of a reorganization of the school system. In Salt Lake City, where average conditions were very good and a good piece of constructive work on the part of the superintendent of schools was revealed, the need of a more individual study of conditions was shown. The study of the Salt Lake City schools was certainly as fine a vindication of a superintendent's work as anything which has appeared in print in the line of survey work, and yet it pointed out individual differences in every school in that city that were rather alarming when viewed from the standpoint of the interests of the children. They were dealing too much with the needs of the so-called "average child."

Have we not been using entirely too much "average", or mass results? It is only recently, as you and I well know, that we have begun to pay some attention to the child of defective mentality, or the child with physical defects. We are beginning to segregate the retarded child, the child who is crippled, the child who is of a low-grade mentality, or who is anemic, or tubercular, and are beginning to provide educational advantages for such suited to their rate of running. The most useful child in the school system, tho, is the child who is above average ability and who too often today is fooling along and dawdling along because he or she is never given work which is up to capacity. They represent what we call the "gifted" children, and they, from the standpoint of democracy, are the hope of our country. And yet we have as yet done almost nothing for such in our school systems, and it may be some time before we will be able to give them the additional advantages they deserve. Too often we are unwilling to recognize the existence of such children in our schools.

A great many people will tell you that such advantages can't be arranged satisfactorily. We have recent experiments which prove the contrary. Here is one. At Montclair, N.J., a few years ago, they organized a class of sixth-grade children from among those who were better than the average fifth-grade child. This class they put thru the sixth, seventh, and eighth grades, in two years, which can easily be done with selected children. The instructions to the teacher were not to push them, but to give them work which was up to their ability. When they had finished the eighth grade this class was tested in comparison with children who had taken the full three years. They measured higher than the children who had taken the longer time. They had not been injured by the process, while democracy had gained a clear year in the training of those youngsters and in getting them into their life work. More than that, instead of staying in the school and dawdling along and learning habits of loafing, they had been learning habits of work.

I am thoroly convinced that a great many college boys who come to us and loaf their way thru college have learned to loaf down in the grades, because they have been brighter and have had better home conditions, have had a better economic background to ensure the better home conditions, and are often better in mental capacity, but they have never been worked up to capacity in school. Instead they have learned to slide along; to loaf on the job and bluff thru; and they come to college and bluff and loaf thru and go out into life as bluffers and loafers. They may, due to superior ability, do fairly good work, but they never realize their possibilities at all.

Again, we might use these tests in supervision in other ways. Suppose we take the test one year, and the next year and for a number of years in succession make the same kind of a test, in the meantime calling attention to where we are standing, actually and comparatively. Here is where we stand in the Courtis tests; here is where we stand in reasoning tests; here is where we stand on a Buckingham or an Ayers spelling scale; here is where we stand on a Thorndike, Ayers, or Freeman writing scale. Now, where are we? Where are we going? Was our work better in 1916 or 1915 than in 1914 or 1913? Are we making steady and consistent progress, or are we holding our own? Such are perfectly legitimate questions of supervision which these tests can answer.

The one that Miss Kerr gave is a very good one. After you have coached up your children in arithmetic, do they hold the training, and especially do they hold it over summer vacation? This is a perfectly legitimate question to ask, and if you find that they do hold it, you have a good deal of reason for congratulation.

Take your spelling in the same way, or your geography. I am convinced that a great many of the facts we teach in geography are of no particular value. Well, how are we going to prove it? That is my opinion. You don't agree with me. Well and good; then so far it is only a matter of personal opinion, and the only way in which we will be able to settle the question will be to make up some tests which will test the efficiency of this instruction from the standpoint of its ability to stick or its usefulness for life work.

We can also test the instruction from the standpoint of usefulness. Take domestic science, for example. We have had much discussion recently as to how best to teach domestic science. Should we teach it in the old formal way of beginning to learn how to light a stove, and then how to cook an egg, and bake a loaf of bread, and a cake, and so on; or should we take up the Gary idea, where the girls go in and help run the cafeteria and out of that learn their domestic science?

We will never settle such questions by argument. The old-fashioned domestic science teacher says that the Gary system is mere child labor. The Gary man says it is good teaching. One opinion is perhaps worth just about as much as the other. Can we not evolve some tests for testing the things which domestic science is supposed to teach, such as the development of the practical judgment of the girl and the giving her an insight into life's problems, so that she can use her head, in addition to knowing how to cook and bake and take care of a kitchen?

Now with some such tests as these we might measure up a number of Gary systems with a number of systems using the other plan, and see where they stand. It is possible, by means of tests of this kind, to keep questioning all the time the efficiency of your instruction and the effectiveness of your supervision. Let me give you an illustration, which Bobbitt gives in one of the reports of the National Society for the Study of Education. He mentions the Union Pacific railroad, which maintains a bureau of efficiency. Some new process is evolved, or some new thing is to be done, and a half-dozen different ways of doing it are soon evolved. At first they are all permitted, but the tests at the end of a year or two show conclusively that two of the ways are very much better than the others; then the other four are taken out, and one of the two approved ways is prescribed. If the tests continue to show that either one of the two gives about the same results the two are allowed to be used, but if, after discarding the others, one of the two comes clearly to the front as the better, then that one becomes the standard method for the Union Pacific railroad. In so far as two methods will give approximately equal results the two are allowed, because they allow for differences in individuals that it is well worth while to preserve.

We are today in the matter of grade instruction *vs.* departmental work for the upper part of the elementary school course in much the position of the Union Pacific railroad when it allows either of two methods to be used, but we may come to the time when the present eight years of graded work may be interdicted as not giving the best results for the children.

The large point I want to leave with you is that there is a whole series of problems which a superintendent can keep putting up to himself, and to his principals and teachers in turn which involve a test or a measurement to find any answer that is really an answer.

Measurements Applied to School Financing

ELLWOOD P. CUBBERLEY

WE are everywhere over the United States facing the question of increased money for schools, and almost everywhere superintendents and boards of education are looking about trying to find what they can do with the problem they are facing. Public education is essentially the process of spending more money in a better way, and each improvement in the matter of education which we make is almost inevitably something which costs more money.

If we want a cheap school system the way to do it, of course, is to make the schools as poor as is possible. If you get very cheap teachers; if you have very poor buildings; if you supply poor and an inadequate quantity of school supplies; if you don't do anything whatever to enforce compulsory attendance; if you let as many children as possible go to private schools; and if you don't develop night schools, or any vacation schools, or any vocational schools, you can perhaps cut the number of children who attend the public schools to less than 50 per cent of the total number, and you can also make it so that the cost per pupil each year will be small.

There are some school systems in the United States that would almost seem to be run on that basis. They have their school system very cheaply managed; they employ home girls as teachers, and at the lowest possible market rates; they supply just as little equipment as is possible; and their education is very largely book instruction. The main things they need are a room, some seats, a stove, and a teacher; the pupils learn what is set down in the books. The course of study frequently says: "Begin at page 42 and go to page 82, and stop."

Such a school system is not only exceedingly cheap, but it requires little forethought as well. Whenever such cities begin to employ superintendents who come to conferences for educational measurements; who get to studying the amount of waste products in their schools and how they may utilize this waste product and get better results; who seek to introduce new and specialized pieces of machinery, as it were, in the manufacture of young people, so that they can turn out a larger percentage of efficient men and women, and have a smaller percentage of waste; and who begin to ask for better teachers and better teaching equipment, each one of which costs money, the costs for education begin to increase rapidly.

There was a time, 10, 15, or in some places 20 years ago, when it wasn't a difficult matter to get more money for the public schools. The school authorities asked for it, and if it seemed at all feasible got it from the town council. That day, I think, has passed forever, and we shall have clearly to prove our needs for nearly all the money we get from now on. We shall have to show that we have equal or greater needs, as I think I said last night, than has the bureau of health, or the bureau of milk supply, or the bureau looking after infant mortality, or the sewer department, or the street department, or the park department, or the police department,—all of which are now in the struggle for city funds, and this presents a rather hard problem.

Education is, in a sense, a surplus luxury. You are, in a sense, doing something for the next generation, which is wholly different from work in which you can demonstrate that you are going to get your money back at an early date. The tax-paying generation is never paid back for educational work. About the only way in which one can ever render repayment for the service which has been rendered to him is to render it, in turn, to the next generation. We are continually working to make a new citizenship, and all the money we put into education is, from a certain point of view, a waste of funds. We have to look at it from the larger point of view of city interests, State interests, and national interests, to become enthusiastic about levying taxes on ourselves to educate someone else's children, and especially to educate them along higher and highly differentiated lines of training. The problem of increasing need for funds for education, and an increasing pressure for funds from all other city departments, is one which we as school officers will have to face from now on. If you happen to be fortunate enough to be in a State where the city council hasn't anything to do with it, and where the school board can, by State law or city charter, levy their own funds, up to a certain limit, you have very decided advantages. I have been contending for some years that that is the rational scheme; that we ought to have it arranged in that way; that there ought to be guaranteed in the city charter, or better still, in the State law, a definite number of mills that may be levied by the board of education on its own judgment, without ever asking the permission of the city council. If a still larger school levy is needed the question should be submitted to the people of the city for a vote, and not to the city council, and for the very important reason that the schools seem to me to be not a part of the city government, in the sense that the patronage departments are, but rather to stand coördinate with the church and the home for the improvement of the race and for doing things for the next generation. Such an institution we can hardly expect an ordinary town council to be enthusiastic about.

In a few of our States this has been done, and in many of these States, within the last few years, there has been an effort on the part of mayors, town councilmen, and politicians to break down such a State law or charter provision. In Kansas, in particular, there was quite a movement made by the mayors last year to bring the schools under the city government, to unify the city tax-rate, they said. To unify it, to be sure, but is there any reason why it should be unified?

New York State, recognizing health as a valuable asset, created a State health council and gave it large independent powers. It is almost a legislature in itself. The State did this simply because it was felt that the public health was too important to be left to the State legislature or to the town councils, or even to town boards of health to control. The State deemed it a matter of such vital importance, and one which looked so to the future, that it ought to be organized separately and by itself, and with large powers of its own. Accordingly, this State health council has power to nullify a local health ordinance and to institute a State-wide ordinance, if it sees fit to do so.

So, in a way, the schools are of enough importance, are coördinate enough with the home and the church and look enough to the future, that we ought to try to keep such legislation in States where we have it, and in the reorganization of city school systems with new charters or State school systems with new laws, we ought to try to get provisions inserted in these which will give to school boards the power to levy certain amounts of money for maintenance, and certain amounts for buildings and repairs, and without any regard to approval by the city council. For further amounts the matter should be submitted to a vote of the people, rather than to a vote of the city council.

In many places, tho, this cannot be done, and we shall have to continue to go to the council and prove our needs. Probably we shall have to ask for what we want, and take what we can get. In many of our cities we are today, as a result of such a process, having a serious struggle to maintain the schools in the way in which they ought to be maintained.

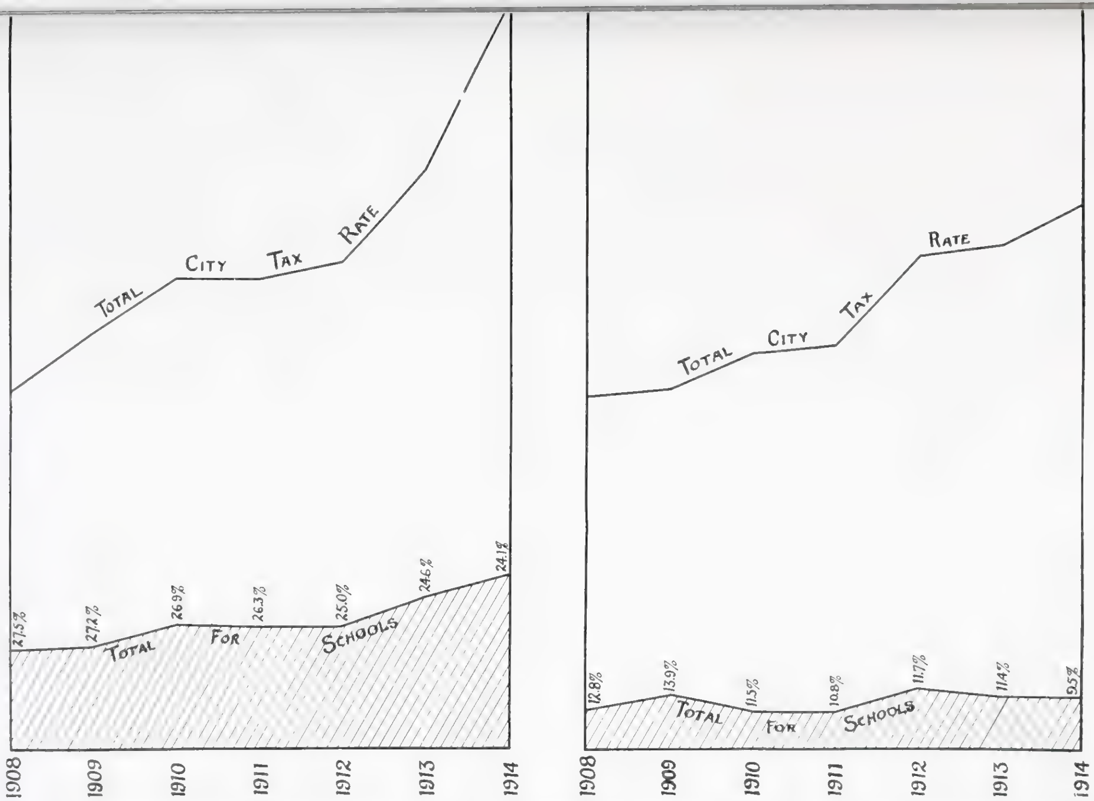

FIG. 1. SHOWING THE COMPETITION FOR CITY FUNDS (Schenectady, N. Y., and San Francisco, Cal.)*.

In both cities the school board has nothing to do with the fixing of the tax-rate for schools, and in each the schools have been completely outdistanced in the race for funds by other city departments. Many other cities will show a similar situation.

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*From Professor Cubberley's *Public School Administration*. Houghton Mifflin Company, Boston, 1916. Reproduced by permission.

I have a couple of drawings here. They illustrate well the problem which faces two cities where the city council has complete control of the school tax-rate. This one shows conditions in the city of San Francisco. The upper line represents the total tax-rate as it has increased from 1908 to 1914; the lower one represents what the schools got out of it, and you can easily see from the drawing that the schools have been losing continually. Then I have the percentages across the line showing what percentage of the total city tax-rate has gone for schools, and these show that it has decreased from 13.9 per cent. to 9.5 per cent.

The next one is the city of Schenectady, N.Y., which illustrates the same process. The upper one is the total city tax-rate, and you see it has been aeroplaning, but when you look at the school tax-rate it hasn't gone up so fast. It has decreased from 27.5 to 24.1 per cent. It has actually lost in percentage of the total, tho it has done better than San Francisco—increased somewhat actually. San Francisco's amount for schools has actually gone downward.

These two cities illustrate conditions in dozens of other cities where the city control of the school tax-rate prevails. The school board goes before the town council and asks for what it needs. The town council, tho, often isn't interested in things which look so far to the future. It is interested primarily in the patronage departments, and the great patronage departments are parks, streets, police, fire, and sewer. These are very desirable things to have, no doubt, but as Mayor Low once said, in New York, what is the use of having parks and streets if we don't have schools? Schools must come first.

In the process of trying to prove your needs I think we school men must come to a new kind of bookkeeping. Last summer I was employed by the city of Oakland, Cal., to do a little piece of work, which was a very interesting one to me. The city of Oakland has been, for some time, developing its municipal undertakings at a very rapid rate. They built a city hall, first planned to cost $1,000,000, but they found this entirely inadequate, and finally spent $2,000,000 on it. They started to build a municipal auditorium at a cost of $500,000, but when they got it finished they found that it had cost them $1,000,000. They have started on a wonderful plan for the development of city docks. They have fine streets, and a great many parks and drives, all of which are very nice. They have been building very expensive schoolhouses, many of them low, rambling, one-story structures, which are very attractive but at the same time very costly. The result has been that tax-rates have jumped to such a rate, to meet interest on the bonded indebtedness, to care for the new improvements, and to meet the upkeep of these new undertakings, that the people last year elected a new administration pledged materially to cut down the tax-rate, and these men went in with the understanding that if they were elected they would make a very substantial cut.

The school department, which is in part independent of the council, but in some features has to go to the council for additional funds, employed me to come up and pass on three things: First, was the school system organized so as to get the most efficient results? Second, was the scope of the school system too large, or not large enough, or was the development poorly balanced? Third, was it costing as much as it ought to cost, too much, or about right? The report which I wrote for them was published in a little document of forty-eight pages, and is sold by the board of education for a dime.

I took 16 western cities where tax-rates were comparable, where all costs for city expenses were comparable, and I showed them, by the comparative method, that their city school system was below the median compared with other western school systems. I showed them that they were not only running on a lower overhead cost, but on a lower percentage for supervision and administration; that they had a larger number of children per teacher than other western cities; and that in almost every feature of the administrative organization they were below the median. That being the case, they could hardly be accused of extravagance.

In analyzing the scope of their system I showed them that their great trouble had been, as far as education was concerned, that up to relatively recently they had maintained merely a traditional school system, with only the elementary schools and a high school. During recent years they have developed a good modern school system, with kindergartens; intermediate, technical, and vocational schools; playgrounds; good athletic work; school orchestras; and other educational advantages. The result has naturally been that with the increasing scope and effectiveness of the education provided there has been a marked increase in its cost.

Another good illustration which I can give you is the city of Salt Lake, in Utah. They had an interesting problem there.

They had an idea that their schools were costing them a great deal of money, and they particularly pointed to the fact that practically 40 per cent of all city taxes went for education, and that they were spending $6.71 per capita for schools, whereas many other communities were spending $4, $4.50, or $5. On the face of it, it looked rather bad. A percentage of 40 per cent of all tax-rates for schools is large; a tax of $6.71 per capita is also rather large. Such would exceed not only most eastern cities, but most western cities as well.

I had a feeling, however, after I had looked at their schools for a week, that there was something wrong in the figures; there was some element which had not been taken into consideration. Their teachers were paid but a small amount: 15 per cent of their teachers were working for less than $520; and they were not spending money freely anywhere that I could see. Their classes were gradually being increased in size, and were then up to an average per teacher of 43 children. I couldn't understand how they were spending any such amount of money, and yet the books seemed to show it. When I analyzed the situation, here is what I found. It is a type of business analysis which every superintendent ought to make. They were actually spending $6.71 per capita for schools; the average for 16 western cities was only $6.27; the median for 16 western cities was only $5.73; 39.1 cents of every dollar raised by taxes in the city went for the maintenance of the schools. In the matter of expenditure the lowest western city was San Francisco, spending $4.27 per capita, and the highest was Pasadena, which has an extraordinarily expensive school system at $10.11.

Let me take it another way. San Francisco was spending 11.9 per cent of its total money for schools for the year that I took; Pasadena was spending 43.3 per cent; the average for the western group was 32.2 per cent; the median was 31.8, and Salt Lake City was spending 39.1. I then hit upon the clue to the whole affair.

I began to investigate how many children there were in Salt Lake City, compared with other western cities. Western cities ordinarily do not have very many children. The average for the entire United States is 17.3 per cent of the population between the ages of 5 and 15 years; the average for the ordinary western city will run about 12 or 13 per cent, because we have so many unmarried men between the ages of 25 and 45,— young fellows who have come west and have not as yet developed a family. The result is that the number of children to be handled in any western city is not very large. San Francisco, for example, has 11.9 per cent; Portland, Ore., 12 per cent; Sacramento, 12 per cent; Seattle, 12.5 per cent; and so I could run down thru the western cities, and none of them has 15 per cent until I strike Salt Lake City, which has 18.5 per cent. There is the whole explanation. With Portland at 12 per cent, Salt Lake City, to provide merely equivalent schools with 18.5 per cent, must spend a little over 50 per cent more money, and compared with San Francisco at 11.9 per cent, they must still spend a trifle more money.

I then began to try to reduce this back to simple terms. What are they spending for each 1 per cent of the total school population? That makes a very much better statement, and when I got at it that way, Salt Lake City was spending 36 cents for each 1 per cent of the total population; the lowest of the entire list was Tacoma, at 32 cents; the highest was Pasadena at 74 cents; the median for the western cities was 43 cents; and the average was 45 cents. With Salt Lake City at 35 cents and the median 43 cents, you have the deficit at once of 7 cents for every child, compared with just the median, and we all know that the median represents merely average conditions. It means, in other words, there are as many school systems spending more as there are school systems spending less.

Taking Salt Lake City with 18.5 per cent of the population, it is spending $6.71. Figured out on the 1 per cent basis, and the median of 43 cents as a desirable expenditure, it should be spending not $6.71 per capita but $7.96, or a deficit of $1.25 per capita of the total population. In other words, multiplied out, it would require at once an increase in the school expenditures of $137,500 merely to bring the schools of Salt Lake City up to the median condition for western cities. You can easily see the situation.

I then proceeded to make up a chart which would show, in picture form, what rate of tax on the $100 of property Salt Lake City would need to raise to provide the same kind of schools as are today provided, provided it had the same percentage of children as the other western cities. If it had the same percentage of children as San Francisco, for example, it would need to raise only 30.4 cents; if it has as many as Spokane, it should raise 37 cents: if it has as many as Los Angeles, 33.2; as many as Fall River, Mass., 52.2. Salt Lake City's position was 47.3.

The position of Salt Lake City is easily shown with reference to the question of children. If you want a large family, all right; but don't then complain because it costs something to educate them. If a city wants families of 5, 6, 7, and 8 children, all very well, but it must not expect to get off on the same kind of a tax-rate for schools that a city of small families does. Such western cities as Portland, Los Angeles, and San Francisco can naturally maintain their schools for 50 per cent less money than can the city of Salt Lake; or, to put it in another way, on the same amount of money they can pay 50 per cent better salaries and maintain a 50 per cent better school system.

Then I took up the question of what they needed to levy to maintain properly their schools, and pointed out that they needed to raise, at once, something like $140,000 more money to bring their schools up merely to the median. If they wanted to provide adequately for their schools they would need to quit entirely thinking in terms of how much per dollar they were spending, compared with other cities, and to substitute how much they were spending for each 1 per cent of the school population. In the superintendent's report there should be no further mention of per capita cost, but instead, how much the schools are costing for each 1 per cent of the children to be educated. An earnest effort should be made to get the people to see the need of bringing their expenses up to at least the median of western cities in the matter of each 1 per cent of the population.

The illustrations I have given you will reveal the kind of study which can well be made in a community where there are a large number of children to be educated, and where people are continually quoting to you how much cheaper per capita some other community is educating its children and conducting its schools. You must think in terms of each unit of your school population.

Let me turn now to another phase of business administration which I think we also will have to face, and that is the question of unit costs. What is it costing not only for each 1 per cent of our population, but what is it costing for each unit of everything else that we have or use? A very significant study has recently been made by the director of the Efficiency Bureau of Kansas City, Dr. Melcher, published in the fifteenth "Yearbook of the National Society for the Study of Education". Mr. Melcher shows how he went into the question of fuel cost, heating cost, building cost, and somewhat into study cost. A still more interesting report, in some respects, is that which has just been published on the "Organization and Administration of the School

City of Denver", by Dr. Bobbitt, in which he analyzes instruction cost and supply cost for the city of Denver in terms of units.

Dr. Melcher found, in his study of fuel conditions, that Kansas City showed these results. First, he took 50 of the largest cities of the United States. Of course different climatic conditions will modify fuel costs, but such ran from 37 cents to $2.70 per pupil per year for fuel. The median was $1.325. Kansas City showed a variation of from 73 cents to $4.60, with a median at $1.62. He then took Kansas-Missouri-Iowa cities, which ran from 70 cents to $2.09, and the median was found to be $1.55. The costs in Kansas City may be perfectly explainable. There may be nothing the matter with them, but they present, nevertheless, a question mark that the efficiency expert of Kansas City is looking after.

He then turned to Kansas City alone and took up the different buildings and different kinds. Thirty-one of these were using oil fuel; 33 buildings were using soft coal; and 18 buildings were using anthracite. The oil was costing from 99 cents to $4.08, with a median of $1.35; soft coal was costing from 73 cents to $4.90, with a median of $1.83; and anthracite was costing from 96 cents to $4.56, with a median of $1.92. Now there isn't a great deal of difference between the minima and the maxima, but there is a big difference between the medians and the maxima. It is a perfectly legitimate question to ask in Kansas City, Are all buildings properly heated? Are some buildings not too hot? It is also a perfectly legitimate question to ask, Are not some of these buildings pretty poorly constructed, not only letting in a lot of cold air, but perhaps having too high ceilings? Are the janitors watching the schoolroom temperatures? Are the teachers watching them? As Dr. Melcher points out, it is very probable that if this study were followed up, and the janitors were given instructions in firing and temperature rating, they could save $10,000 a year on their fuel bill. If so, that would pay for their efficiency bureau about three times over.

Another question which he took up there is how much it cost for each thousand cubic feet of air that is heated. Other conditions will now come in, such as how much night work is carried in on these buildings? How much are they used as community centers? We ought in time to evolve some standards by which such questions may be answered.

Turning now to the Denver study, I want to consider briefly another type of cost questions, those relating to instruction.

Professor Childs gave you some statistics of this type this morning. In Denver, figures were collected to show what it cost for 1,000 hours of instruction in the different subjects in the different high schools of the city. In the West Side high school it cost $1.32 for 1,000 hours; in the East Side high school, 93 cents; in the South Side high school, 87 cents; in the East Eleventh school, 82.7 cents; in the Manual Training high school, 93 cents; and in the North Side high school, 62 cents.

These figures raise a number of interesting questions. Taking the West Side high school, why is the cost so high, unless this school has a particularly small number of children per class, or is as yet an undeveloped school? Some reason ought to be sought as to why instruction costs run high there. There is also a similar question as to why instruction costs in the North Side high school run so low. It may be that this is inadequately provided with teachers, or that this school may even be too expensive to retain.

Turning to the cost of instruction per student hour for the different subjects, Dr. Bobbitt found these: English, from $53 to $65 per 1,000 hours; mathematics, from $57 to $79; history, from $46 to $73; modern languages, from $72 to $93; science, from $43 to $86; drawing, from $50 to $107; and Greek, which was offered in but one high school, was costing $322 per 1,000 hours. When we look at these figures the wide variations in costs naturally raise questions. Perhaps history in some high schools is taught too cheaply; perhaps they should have better equipment, more library books, and perhaps reduce the size of the classes by putting in more history teachers. It may be that the modern languages are taught in too small sections. It may be that you can't help this. Science, which we expect to be expensive because of laboratories and smaller sections, is not expensive at all; under these conditions, apparently, Denver could push science instruction in high schools without any great cost. Drawing runs up a little but is not particularly high. Greek is the expensive luxury. It may be that they can afford it, but it may be, on the other hand, that Greek is provided at the expense of other things in the system which are more vital. There is no basis for throwing Greek out on its high cost, but there is a pretty serious basis for asking Greek to stand up and prove worthy to remain.

Again, in pupil supplies, Dr. Bobbitt found that the cost of supplies varied from 6 to 25 cents per year for pupils' supplies, a median of 12 cents; textbooks from 23 cents to 83 cents; with a median of 47 cents; and supplies used by the teachers in instruction varied from 13 cents to 24 cents, with a median of 16 cents. From such figures it is a very serious question if all of these schools are not being undersupplied. When Dr. Bobbitt correlated these figures with the retardation sheet for each school, he found the most serious cases of retardation accompanied the lowest expenditure for supplies. Instead of being economical, such economy is frightfully expensive. It means unduly increasing the repeaters. Of course you may say that the farther down in the grades you keep the children the cheaper it is; if you get them along they only get into high school and cost you more money; that the cheapest grade teachers you have are third and fourth grade teachers, so keep the children there as long as you can. If you follow this argument out the logical thing to do would be to abandon the public schools entirely, and turn the children over to private and parochial schools to be taught. But we didn't start our schools on that basis, and we aren't working on that basis, and if you look at the question from any point of efficiency, then the teaching of repeaters is a frightfully expensive piece of work. As citizens and tax-payers we have the right to grumble pretty seriously at the school board or the superintendent who allows such conditions to go on.

It may be that in some schools we are spending too much, and that possibly some economies could be made in some places. On the other hand, it may be that the whole expenditure is too low, and that everything along the line should be raised.

Coming back to what I said in the beginning, the process of education is primarily the business of spending more money in a better way, and there is no other way to make good schools. You must get at the process of spending your money so as to make both sides of your dollar count, and get the maximum results for the money you are putting in. At the same time, you must work to get more dollars to spend to increase the value of your output.

You will never be able to prove your needs to "the man in the street", or to the man on the council, until you can show him, in some terms that he can understand, that you are getting value received for the dollars he gives you. If you tell him you are producing men and women, that you are doing wonderful work for the citizenship of our republic, and that you are turning out young people instilled with the highest ideals, he may believe you, but he might with propriety very seriously question whether you know what you are talking about.

But if you can prove to him that you are getting good instruction along certain lines; that you have averaged up the cost so that you haven't any big extremes; that if you had some more dollars, a certain added percentage to put on your funds, you could do so much more with it, then you have some basis on which to talk. Generally what happens is this: The school budget sent up to a city council asks for, say $73,000 more than costs had last year, but with no clear statement of why you need this amount; no statement of added needs; no statement as to unit costs from which added expenditures have been calculated; and little upon which a councilman can estimate the business efficiency of a school system.

It is something of this type of accounting that you will have to face in your business relations. In your State of Indiana, for example, very few of your cities publish an annual report at all, and I think one reason why the superintendent's pay in Indiana is lower than it is in adjoining States, one reason why you have more difficulty in getting money for your teachers' salaries, one reason why you have difficulty in getting more money for expansions, is that you don't tell the people what you are doing and of your needs by publishing an annual report. Once each year you should render in print an account of your stewardship; as manager of the business you should report to your board of directors, and thru them to the stockholders of the corporation, telling them what you have done with the money they gave you last year, and how much more you could do if they would give you more next year. Only on some such basis can we safely face the question of increasing cost, the question of higher interest rates, the question of the greater struggle for city funds. Unless this question of finance is faced intelligently and in a truly businesslike manner, I think many superintendents of schools are headed for trouble.

Principles of Scale Derivation with Special Application to Arithmetic, Geography, History, and Grammar

Bruce R. Buckingham, Educational Statistician for the State of Wisconsin

The subject of the report which I bring to you this morning is a rather ambiguous one. We all know that at a certain point in any development there comes along a theory to justify the cruder practice which has hitherto characterized it. It has seemed to me that there is emerging a theory in the matter of scale derivation, and that if we can apply it we shall be able to derive scales of much greater richness and compass, and in much greater numbers than we have been able to derive them hitherto.

Not long after I became connected with the superintendent's office at New York, I was asked to undertake an investigation of the academic teaching in the fundamental subjects in different types of elementary schools. The opportunity which this offered of putting into practice the application of experimental methods to the elucidation of particular educational problems made the project seem to me very attractive. The subjects in which it was decided to test the children were arithmetic, spelling, geography, history, and English grammar. The seventh and eighth grades of sixteen schools were examined on March 13 and 14, 1915. On June 15 and 16, 1915, they were again tested in the same subjects with material which was designed to be of the same difficulty as that of the material used in March.

I take it that any testing which is carried out upon a scientific basis must be composed of three rather definitely fixed lines of activity. There must be a preliminary test, when material is evaluated, conditions are estimated, and the general attitude of the experimenter and the subject is determined. Ordinarily the material derived from this preliminary test will not be used. Then there is the real test, the one for which the preliminary test was a preparation. This constitutes the basis of the report. The answer to the question is derived from it. And, thirdly, there is the control test whereby conditions are set over against conditions in such a way that comparison is possible.

Now in the testing of these schools in New York City the preliminary test was occupied with an evaluation of the material to be used. The particular object was to obtain a certain parallelism of the tests. For the purpose that I had in mind a progress record between March and June could not be obtained unless we could use material the difficulty of which was known and preferably known to be of equal difficulty. Accordingly, a large number of questions was used in an attempt to evaluate material for these different school subjects. The real test consisted of the application of a selection from these questions to the experimental schools in New York, of which there were 8; and the control test was represented by the administering of the same test material to 8 other schools pursuing the regular course of study.

The number of participants in the real test was about ten thousand both in March and in June, and the number of participants in the preliminary test differed greatly for different kinds of material. I am not giving you any report here for the preliminary test, nor am I giving you any report of the spelling test. Ten questions were given in arithmetic in March and 10 in June. You will find those 10 questions in March on the first page of the material* you have in your hands, and the ten problems for the June test are on the second page. In geography there were 40 questions given in the real test. These occupy pages 3 and 4. In history there were 24 questions; and in English there were 28, except for the fact that in the first half of the seventh grade only 20 questions were given.

At this point permit me to digress momentarily to say that there a great many situations similar to the one which I am here reporting. Tests are no new things and I fancy that in looking at these questions they will appear to you to be not greatly different from the tests which you have been familiar with as teachers and supervisors. They are instruments that have been used by teachers and supervisors time out of mind. Every year, in most places every half-year, and in many instances more frequently, children are tested in a number of subjects with the idea of finding out how they are maintaining themselves or whether they ought to be promoted or not. The particular and temporary need having been served, the material and the results have reached the waste basket. It is no doubt true that if the material which is so disposed of in a single week in our schools could be gathered together it would make the most important contribution to education that could be devised. Effort without knowledge of results, blind, wasteful, trial-and-error methods mark the progress of the young teacher who faces problems unaided, because thousands of people who have solved them before her have not thought it worth while to save their results.

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*For material referred to see Appendix.

To turn to the tests as they were given in New York. More than 20,000 returns were received in the March and June tests taken together in each subject, or 100,000 papers in all. This involved the examination of 200,000 answers in arithmetic, 400,000 in geography, 240,000 in history, 280,000 in grammar, and 1,000,000 words in spelling. It is from this material that I propose to offer today scales for measuring attainment in each of the subjects except spelling, as far as the relatively small number of questions permits this to be done.

At the outset permit me to state the way in which the questions were selected. A previous study of spelling gave a hint as to method. In the rating of spelling, each form is either right or wrong, and it has never been customary to allow part credits for words only slightly misspelled. It occurred to me that the same procedure could be followed in other subjects, provided a standard for each question coud be set up such that failure or success in reaching it could be accurately determined. Under such circumstances each child's answer to a question might be rated as right or wrong (perhaps satisfactory or unsatisfactory would be a better term), and no part credits for partial success need be allowed. This method presented no particular difficulty in arithmetic. In the content subjects, however, of geography, history, and English grammar, the task was not so easy. It is clear that the method of right and wrong cases may be much more easily applied in the content subjects to the more formal aspects of them. It is clear that each of these content subjects has a body of facts connected with it about which there is little or no dispute. Answers to questions about these facts may, with propriety, be rated either as right or wrong; and, concerning the answers, no one who is informed can be in doubt as to whether they are right or wrong.

I realize that you will feel some disappointment that geography, history, and grammar have been treated only in their more formal aspects that is, that questions are of the informational type almost exclusively. I do not believe, however, that this affords justification for any feeling as to the limitations of the test method when applied to content subjects. There are three reasons why this appears to me to be true.

In the first place, there are parts of every fundamental school subject which are so fundamental that ignorance of them is a misfortune, and the various States have defined what the common school education shall be. They have defined it in terms of fundamental parts of fundamental subjects, and they certainly contemplate that the child shall be informed, shall know, shall remember, if you please, these fundamental parts of fundamental subjects. The world, rightly, I think, judges praise to the well informed person, and when you find the business man criticizing the schools, you generally find him doing it on the basis of things that children don't know.

In the second place, we need to be little disturbed about the fact that these questions are information questions because there is a direct relationship between information and thought in any given field. Those who do well in an information test will also do well in a test requiring inference or deduction. Just before I left New York I gave an informational and a thought test in history to the same groups of children. I have not completely worked out the conclusions yet, but the correlation coefficient between information ratings and thought ratings is unquestionably positive and high. If further study of the matter confirms this, the reliability of information tests as indirect measures of total ability within the field in question becomes apparent. The doctrine of indirect measurement is no new thing. For a long time we measured fatigue by measuring the distance between the points of the aesthesiometer, and altho the correspondence between cutaneous insensitivity and fatigue has been more or less discredited it wasn't discredited on the ground that the fatigue element could not be measured, provided there was a correspondence. The method of indirect measurement is well illustrated by the thermometer; we don't measure the heat, we measure the height of the mercury column, which varies directly, or nearly so, with the heat. It is not always necessary to measure directly the thing we want to know about, but it is sometimes possible to measure a thing which varies with it and which in itself is much more easily measured than is the thing which we want to know about.

In the third place, it is possible to develop a technique with respect to thought questions whereby they may be handled in practically the same way that these information questions were handled in the work at New York. I can only suggest the lines along which this development may take place. The first need is to secure a judgment as to the value of certain types of answers. Suppose that the question is the following: "Check the five most important topics in the following list: Paul Revere's Ride; The Purchase of Alaska; The Discovery of Lake Champlain; John Brown's Raid; The Monroe Doctrine; The Capture of Major André; The Visit of Lafayette to the United States; Magellan's Voyage Around the World; The Boston Tea-Party; Construction of the Panama Canal; Washington's Journey to Fort Dequesne; Sheridan's Ride; The Purchase of Louisiana; Making of the First American Flag by Betsy Ross." This is clearly a matter of judgment. The answer, from one point of view, must be regarded as correct, no matter what it is. Betsy Ross and the American Flag may be allowed to vie in importance with the Monroe Doctrine and the Louisiana Purchase, but most of you if you were rating answers to this question would feel that the child who checked "Betsy" was not entitled to as much credit as another child might be who refrained from doing so. Just where one might draw the line and say that this topic or that should not be included among the five most important is a question which all of you, I am sure, would feel to be difficult. You would feel that any decision on your part might be arbitrary and somewhat indefensible. To set up the judgment of one person against another is repugnant to our ideas of proper procedure. We do not, however, feel this compunction to such a degree when we find that another person agrees with us in our judgment; and if we find yet others in agreement with us, our opinion deepens into conviction and we reach a point where we feel almost as certain of our ground as we would be in the case of an answer to a fact question such as: "In what war was the battle of Gettysburg fought?" What I am coming to is this: It is quite possible to secure the judgments of competent persons as to typical answers, and, having secured a concensus, to use the consensus in the same way that facts are used in the rating of information questions.

It may seem that the inferential question which I have used as an illustration is of a peculiar type which may lend itself to treatment by the method of right and wrong cases more readily than would most questions requiring a pupil to exercise individual thought. No one would deny, I should suppose, that the qualities of judgment and estimate of values called for in the question about checking the five most important historical topics are among the qualities which we most desire to cultivate in our school work. There are, however, many other types of mental processes which it is equally desirable to train and foster.

Let us therefore take another illustration which will probably present as much difficulty in the application of the method of right and wrong cases as any that would be likely to be used. Suppose the question to be: "Account for the fact that the climate just east of the Rocky Mountains is unusually dry." I have actually used this question and have found it quite practicable to rate it as either right or wrong without allowing part credits, provided the necessary preliminary judgments are secured as to what characterizes a satisfactory answer. Taking a rather wide selection of answers at random one may manifold them and issue them to a number of competent judges. From the returns which I myself received regarding this question, it did not prove to be difficult to formulate satisfactory answers, or rather elements necessary to a satisfactory answer. This does not mean that only one answer was accepted as correct. According to the judges, several sorts of answers would be acceptable, involving different elements more or less expressly stated, such as the fact that the west winds are saturated with moisture; that the mountains act as barriers; that the air in rising over the mountains is cooled, thereby precipitating its moisture; that the winds from other directions than the west have been deprived of their moisture before reaching this region "just east of the Rocky Mountains". The procedure in thus standardizing answers to thought questions is rather tedious; but it is perfectly practicable and surprisingly satisfactory if the number and importance of the preliminary judgments are sufficient. I think, therefore, that we are ready to set up scales and standards of achievement in content subjects, and I think that it will be done along the line which I have suggested, and one phase of which I shall illustrate in this report.

The whole theory of scale derivation has taken on form and substance. It is apparent, for instance, that there are two methods developing in scale-making, viz., the judgment method which Thorndike and Hillegas followed in penmanship, drawing, and composition, and the ratio method which I used in spelling and which has since been followed by Ayers in the same subject and by Trabue in language and Starch in arithmetic.

It may readily be shown that the school subjects are susceptible of arrangement in a certain serial order which will indicate the methods of scale derivation applicable to them. At one end of the series will be such subjects as spelling and arithmetic, which lend themselves particularly well to the ratio method, that is, to the expression of the relation between the actual number of correct responses and the possible number of correct responses. At the other end of the series are such subjects as composition and penmanship. Scales for these subjects must be derived by the judgment method. One sample of handwriting is better than another, not as a fact but as an opinion. A specimen of English writing is better than another, precisely because competent people think it is better. Between the extremes of the school subjects (represented on the one hand by arithmetic and spelling, and on the other hand by composition and penmanship) are a number of subjects to which the ratio method and the judgment method may both apply, according to the material which enters into the scales to be derived. Geography and history may typify these intermediate subjects. That there are parts of these fields so precise and unequivocal as to lend themselves to the same sort of treatment that may be given to spelling, no one will doubt who reads the geography and history questions which you have in your hands. As to the parts of these intermediate subjects which are not so definite, the judgment method may play an important rôle. It may do so on the one hand purely on the analogy of the judgment method used in the derivation of the Thorndike handwriting scale; that is, it may simply employ the theorem, "Differences which are equally often noticed are equal." Answers to questions in geography, history, science, or literature will then be judged pair by pair as to differences in merit, and scaled directly as a result of such judgment. This method is perfectly feasible, and there are no doubt parts of these subjects which will be best scaled in this manner. Or, on the other hand, the judgment method may be applied in conjunction with the ratio method in some such way as I have indicated above, that is, by securing a basis of judgment as to the rightness of the answers.

Thus you will see that I do not think that the limits of scale derivation have been reached; indeed, I do not think we have much more than embarked upon this particular phase of educational inquiry. We shall have, before long, scales in all school subjects, and not merely one but many in each subject. For instance, we shall have for spelling not only a general scale but one for each grade. In arithmetic we shall have a variety of scales, not only those for each grade, but those for oral and written work, abstract work, and problems. In composition we shall have scales not only for each grade, but also for the different types of discourse and for letters of various kinds. The movement, therefore, for standardization is only in its infancy. To my mind it is one of the most hopeful movements in education. It is unnecessary for me to enlarge upon this point to an assemblage gathered under auspices such as these. I think, however, that our supervision will be vastly improved by it; that our children will be more rapidly and effectively taught; that inefficient teachers will no longer be able to hide behind our ignorance; and that the far-off and dubious aim of education—an aim too remote to be effective to the general practitioner—will be replaced by a goal which is in sight, by a motive which is dynamic and energizing, and by an appeal which is not a generalization nor a hope deferred, but an example of what pupils have actually done—an example so concrete that it cannot be misunderstood, so obvious that it cannot be dodged, and so fair and impartial that it cannot be resented.

It is exceedingly important that the exact procedure in administering of these tests should be set forth, but to arrive at the scales themselves this morning it will probably be necessary for me to take this up at the round table this afternoon, should you want me to do so. It makes a whole lot of difference how the tests are given. It makes a whole lot of difference how they are rated, and if you are going to go back to your homes and use any of these, you should know how it is done; not that my way is any better than your way would be, but it may be different. The test papers were sent out by the city superintendent to the principals with instructions. At the central office when the papers were returned, after having been rated by the teachers, according to instructions, they were re-rated on a one-fifth random sample basis. If after selecting one-fifth of the papers, the number of reversals of a teacher's ratings was less than 3 per cent of the questions rated, the set was considered to have been satisfactorily handled by the teacher. If there were more than 3 per cent of reversals, an additional one-fifth of the papers were selected, and if there were not then less than 3 per cent of reversals, the papers were sent back to the school for re-rating.

As indicating the value of the arithmetic material for test purposes, I call your attention to this Figure I, which shows the frequency of the ratings in the two halves of the seventh grade in the March test. You will notice that in the seventh grade, first half, there were many children who were unable to get a single example right. This horizontal scale is for the numbers of problems solved correctly; the vertical scale is for per cents of children who solved them correctly. About 13 per cent of the lower seventh grade children were unable to solve a single example. The test material in arithmetic, therefore, was not ideally adapted to the lower seventh grade because, of course, there is a wide variety of ability among these thirteen children out of one hundred, none of which is tested because they all get the same rating.

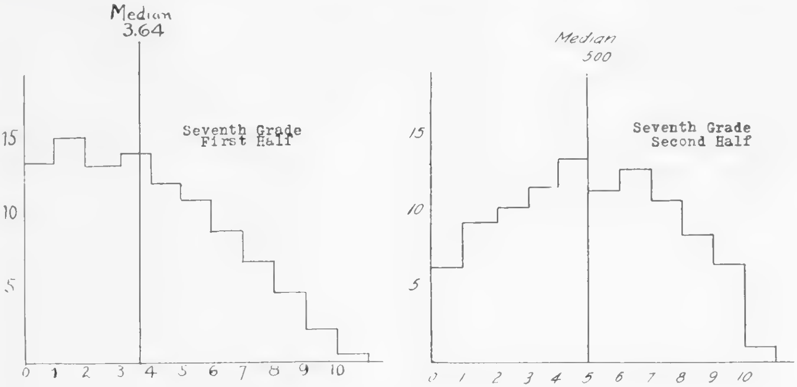

Fig. I. Frequency of Arithmetic Ratings: Per Cent of Questions Answered Correctly.

The situation is a little better in the seventh grade, second half. We have a surface of frequency which approaches more nearly the normal type, the children who did very poorly being more nearly balanced by those who did very well. The median in the lower seventh grade was $3\frac{2}{3}$ examples done correctly out of 10; in the upper seventh grade it was exactly 5 examples.

Figure II is for the March test in arithmetic in the lower eighth and upper eighth grades. The surface is only fairly satisfactory for the upper eighth. Note the piling up of the children at the upper end. The medians are: for lower eighth grade, 6.2

problems answered correctly; for the upper grade, 7.8 answered correctly.

Permit me to remind you that this should be taken with some degree of caution. The problems are not of equal difficulty. Whenever any showing such as this is made, or any tabular showing concerning the number of examples correct or questions correct, or items of a test correctly solved, the elements (here the problems) are found to be decidedly unequal in difficulty. A tabulation or a graphic showing, however, of the personal scores of children, if we understand that it does not mean what it appears to mean—viz., that the problems are of equal difficulty—is useful, because, taken as a total measuring instrument, a group of ten problems such as you have here does have value for the comparison which it enables you to make between conditions in one place and conditions in another. The thing that we must look out for is that we do not judge that a child who answers 6 problems correctly does three times as good work as does the child who answers 2. We must make no such comparisons.

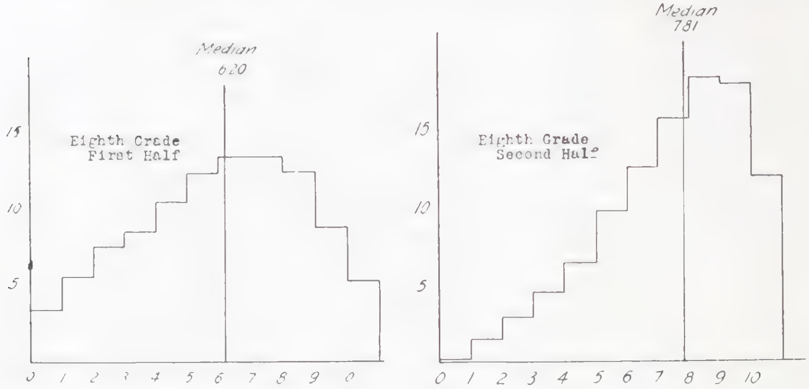

FIG. II. FREQUENCY OF ARITHMETIC RATINGS: PER CENT OF QUESTIONS ANSWERED CORRECTLY.

Before I show you any of the scales for the school subjects under discussion it will be necessary for me to give you a brief statement of the way in which the ratio method of scale derivation is applied. The fundamental assumption is that the ability of pupils in each grade is approximately of the normal type.

Figure III will give you an idea of the idealized surface of frequency which is commonly called normal. As I have experimented and studied the question of the distribution of ability among school children I have come more and more strongly to the opinion that this is the true pictorial representation of the distribution; in other words, I believe that the distribution of ability in each grade is substantially of the normal type, and I do not arrive at that from any hasty conclusion or from any desire, great tho it may be, to use the frequency surface of the normal type on account of its simplicity. As some of you perhaps remember, I experimented rather fully a few years ago with distributions of an asymmetrical character and the results were almost negative. It appears that the eliminative process which is going on in the public schools from the lower grades to the upper grades does not skew the distribution to any important degree. It simply moves it up.

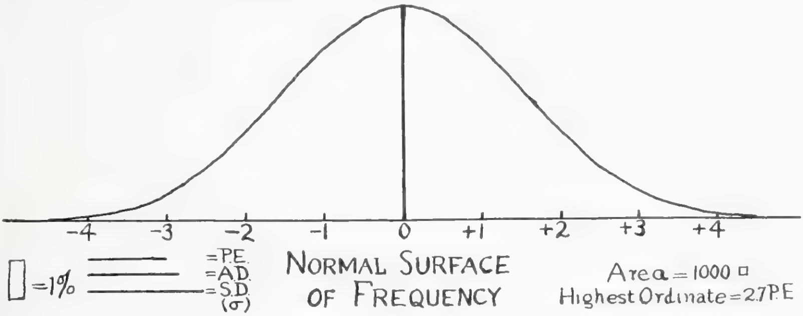

FIG. III. NORMAL SURFACE OF FREQUENCY.

The theory, therefore, upon which these scales are derived is based upon the assumption of a normal distribution of ability. When we say that a question in geography or a problem in arithmetic is answered by 50 per cent of the children, we mean that half of the children possess such ability as is necessary to answer the question or more ability than is necessary to answer it. Ability is measured along the base line of the figure; low ability being at left and high ability at the right; and the ability corresponding to a 50 per cent problem would be presented by such a point on the base line as would leave half the area of the surface to the right of its perpendicular, the right being the high ability end. It would be located here at zero (indicating) and this would be the perpendicular. Half the surface of the figure is to the right of the perpendicular.

Suppose that the problem were answered by only 25 per cent of the children of a grade. The placing of this problem would be at a point on the base line to the right of which only 25 per cent of the area of the normal surface lies. Such a point would be placed here (indicating), and the distance from the median ability to this point is by definition the "probable error" of the curve. The probable error, then, is the distance from the median to a point on the base line at which a perpendicular, if erected, will cut off 25 per cent of the area. This distance is our unit, and all measures of ability as shown in the following scales are in terms of it.

A question answered by 75 per cent of the pupils of a grade would be placed here (indicating) where the perpendicular would leave 75 per cent of the area to the right. This would be at −1 P.E. A question answered by 91 per cent of the children would be here, at about +2 P.E. (indicating). Any given percentage has its point on the base line, a perpendicular at which leaves to the right that same percentage of the area. In our work the area to the right of such a perpendicular represents the proportion of pupils whose ability is such that they can answer the question correctly.

The diagram which I now show you (Figure IV) is a series of scales for the difficulty of 20 problems in arithmetic. There are 5 scales, one for each of the 4 highest half-yearly grades of the elementary school, and 1 general scale for the 4 grades combined. The series of numbers at the top of the diagram (indicating) are P.E. units multiplied by 100. That is to say, 180 means 1.80 P.E. The questions are indicated by numbers along the scales and under the P.E. value to which they belong. If the diagram were complete there would be erected on the entire top line a very large normal surface of frequency whose highest ordinate would be at zero, and 25 per cent of whose area would lie to the right of +100, with 75 per cent to the right of −100.

Notice that the numbers below each scale line are the numbers of the problems in the March test, while those above the line are the numbers of the problems in the June test.

The second series of figures at the top of the diagram (indicating) represents the percentage of pupils who solved the problems correctly. You will notice that 75 per cent corresponds, as it should, to −100 on the upper line, and that 25 per cent corresponds to +100. Other correspondencies are as indicated thruout the extent of the scale.

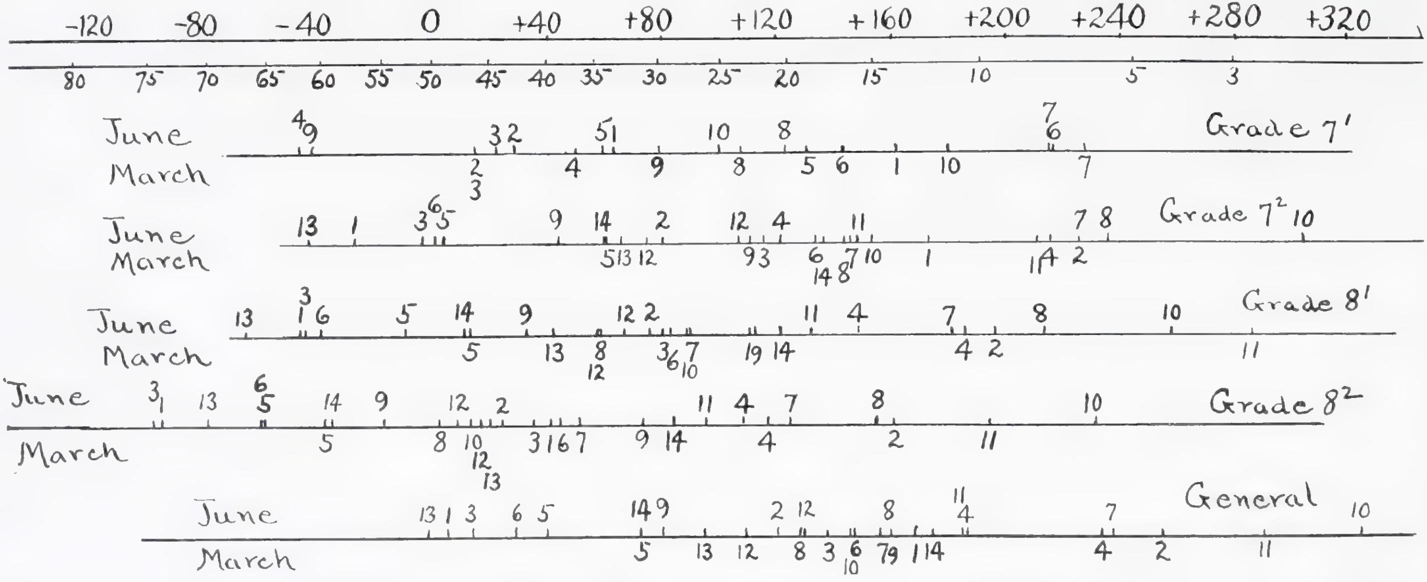

Fig. IV. Scales for the Difficulty of Twenty Problems in Arithmetic.

In the March test the "map problem" which you may read as No. 1 on the first sheet of the material I have given you,* was answered correctly by 7½ per cent of the pupils of the lower seventh grade. You will see that it is found between the figure 5 and the figure 10 of the per cents. By using a conversion table, it is found that a problem answered correctly by 7½ per cent of a group of pupils would be placed on the base line of the surface of frequency at +2.13 P E.; and you will notice that it lies here a little to the right of 200 (indicating), according to the P.E. values of the top line. It will be interesting to follow this problem as it appears in the other grade scales. It was answered correctly in the upper seventh grade by 12.8 per cent of the children. This corresponds to 1.69 P.E. You will therefore find this problem located on the upper seventh grade scale about midway between 10 per cent and 15 per cent, and a little to the right of 160 (indicating Problem 1). In the lower eighth grade, problem 1 of the March test was solved correctly by 24.1 per cent of the children, which locates it at +1.04 P.E. In the upper eighth grade it was answered correctly by 41.6 per cent of the children, which places it at +0.32 P.E.

Notice the regular increase in the ability of the different grades as shown by their success in solving this first problem of the March test. If we join the points at which the problem falls on each of the scales, we shall almost have a straight line. This is true for a number of other problems. If it were true for all of them we might draw a straight line thru the four points for each problem. The slope of this line, or the angle it makes with one of the scale lines, indicates, so far as one problem can do so, the amount of increase in the ability of children in each successively higher grade. Notice that the angle made by the line joining the points for problem 4 of the June test (indicating) would be greater than that made by the same sort of a line for Problem 8 of the March test (indicating). This means that the data for problem 4 indicate less improvement from grade to grade than do the data for problem 8. The greater the angle, the less the improvement. If the angle were 90 degrees, no improvement would be shown. Theoretically all the lines should be straight and they should be parallel that is, they should make the same angle with the scale lines. Doubtless if the number of children were very great, the straightness and parallelism of the lines would be nearly approximated. The slope of these lines is an interesting measure of the amount of improvement from grade to grade. It deserves a much fuller treatment than I can give it here.

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*See Appendix.

It will be interesting to note some of the characteristics of the problems in arithmetic as to their test value. Problems 7 and 9 in the March test, to which your attention is directed, as the "pencil" problem and the "factory products" problem, are what may be called median problems for the lower seventh grade. The first was solved correctly by 50.8 per cent of the children and the second by 46.9 per cent of the children. Ability to solve either of these problems, therefore, places a child, so far as the problem is concerned, at the average ability of the class, or better. These two problems may be used to good advantage as test problems for the grade. A child who cannot solve them affords evidence of being below the average ability of the grade. On page 2 of your material you will find two other problems which for lower seventh grade children in June proved to be practically median problems. They are the third, or "Texas" problem, and the seventh, or the problem about the farmer's wife. The "Texas" problem was solved correctly by 54.3 per cent, and the problem about the farmer's wife by 51.7 per cent of the children. In the same way we may select for other grades directly from this scale problems which correspond to typical grade ability. Such are, for the upper seventh grade, problems 5, 9, and 10 of the March test, and 8 and 10 of the June test; for the lower half of the eighth grade problems 4 and 8 of the March test, and 6, 9, and 10 of the June test; and for the upper half of the eighth grade, problems 6 and 10 of the March test and 1 of the June test. Problems indicating other than typical ability might also be selected. For instance, problem 4 of the March test—the problem about the economy of buying potatoes by the bushel—is a problem the solution of which implies for children of the lower seventh grade an ability which just places them in the upper third of the grade. In the upper eighth grade, however, its solution would place the child just short of the upper three quarters of his grade, or, conversely, a child who failed to solve it would give evidence of belonging to the lower quarter of his grade. In a similar way, other problems lend themselves well to use for purposes of diagnosis. Problems may likewise be selected of approximately the same difficulty. In fact, the entire March and June tests are of about the same difficulty, altho this equality does not show up in the scale, largely because the three months that elapsed between the giving of the tests makes the June examples appear easier than the March examples.

The method of placing the problems on the general scale is one which I will not enter into in detail at present. If you care to have me do so, I will describe the method this afternoon. It will be sufficient to say at this time that the placing of the problems is made by using all the data from the different grades and so combining them as to give the best average placing with reference to the median of the lower seventh grade. It is to be understood that zero means the median ability of the lower seventh grade. This will account for the fact that so few problems are placed below the zero point. I shall take up the remaining scales this afternoon, and shall try to give you an opportunity to ask questions.

Round Table: Principles of Scale Derivation with Special Application to Arithmetic, Geography, History, and Grammar

Led by B. R. Buckingham

As matters developed this morning, I was not able to give you just the talk I had intended to give you. I had planned to take forty-five minutes for the presentation of my material. It was my intention to give you an opportunity this afternoon to ask questions about the presentation of the morning and to discuss it. Having been unable to complete my report and having been obliged to abbreviate parts of it, I shall first try to take up certain omitted topics and then to present the scales for geography, history, and grammar.

In the first place, I want to show you how the children's answers were rated. The score sheet which I use is being passed around to you.* You will recall that all questions are rated as either right or wrong, no part credits being allowed. All that is necessary, therefore, for a complete scoring is to indicate whether the question is right or wrong. The pupils are identified by number across the upper part of the squared surface. One sheet is to be made out for each class. If, however, a class consists of more than one grade, a sheet is to be made for each grade composing the class. In order to make a study of the difference due to sex, I have caused entries for boys to be made in black and those for girls to be made in red.

The directions to the teachers require them to number their classes, giving the first boy the number "one" and the remaining boys the next consecutive numbers. If a mixed class had 16 boys in it, the first girl would be number 17, the next 18, and so on. The horizontal totals of scores give the question results, and on the right you will notice two triple columns, one for the number of answers not correct, and one for the number correct, each divided into boys, girls, and total. At the extreme left are listed the questions either by number or by a catch phrase

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*Figure I.

Test in________ (SUBJECT) Series______ Test No.______ Questions______ to______

City______ State______, School______ Grade______, Class______, Date given______

Time of Day______ No. of Papers: B______ G______ T______ Class Average: B______ G______ T______

Class Teacher______ Scored by______

No. of Ques	Pupils by Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	Not Correct			Correct		
	Ages:																																									B	G	T	B	G	T
	Total Not Correct																																														
	Total Correct																																														

and a number. For instance, in arithmetic we may call question number one of the March test the "map question", because it is about the scale on a map; question number two may be called the "milk-man question", number three, the "fruit question"—anything to distinguish it, altho, of course, that isn't exactly necessary. The number will suffice.

Question number 1 may be supposed to have been entered; and on the line running from left to right, score marks show the number of times it was incorrectly answered, black marks being for boys who got it wrong, red marks being for girls who got it wrong. At the right, under the "Not correct" caption, the number of boys who got it wrong will be shown, then the number of girls who got it wrong, and the total of the two. Let us suppose that the number of boys who got it wrong was 8, and that there were 15 of them in attendance. Accordingly, 7 must have got it right, and 7 will be entered under the caption "Correct" and the sub-caption "Boys". If there were 18 girls in the class and 7 got it wrong, that would leave 11 to be entered under the sub-caption "Girls", and the 7 and 11 added would give 18 as the number in the class who got the question right. The vertical totals will give the pupils' scores. Suppose pupil number 1 gets questions 3, 7, and 10 wrong. Under the number 1 (his number) and opposite question numbers 3, 7, and 10, score marks will be entered. The total at the bottom after "Total Not Correct" will be 3. The "Total Correct" will be 10 less 3, or 7, which is the pupil's score.

That is the scheme of this double entry score sheet, and nothing that I know of gives such richness of detail as does this kind of a score sheet. You will find, as I go a little further and tell you about how the scales are derived, that it is precisely this richness of detail which we need and which customarily we do not get.

Besides the uses illustrated in this report there are many others to which such a score sheet may be put. Not only does it give pupil scores and question scores, but it permits either of these scores to be distributed by cities, States, schools, grades, or classes. The effect of the date of giving the test—whether early or late in the term—the effect of the time of day and of the size of class may be studied. Sex differences both in gross and for different types of questions may be shown; and all the matters which I have just referred to may be related to the ages of the children. By using other kinds of marks besides score marks, types of errors may be studied. Thus, in spelling, I have used a cross to indicate illegibility, a circle to show that the word was omitted, an "a" to indicate an absurd form of spelling, and an "s" to show a substitution. I should strongly advise all teachers to rate their ordinary test papers by using some such double entry score sheet as I am showing you. It serves equally well when a certain number of credits is assigned to each question; and the knowledge to be obtained from such an analysis of material will become more and more valuable as the years go by. I said something this morning about the waste involved in failing to keep the results of tests after their immediate purpose has been served. This is the form in which I should file the results, attaching a copy of the questions to the score sheet. For purposes of identification, I should have each pupil keep the same number as long as he was in my class, and should file against the set of score sheets a list of the pupils' names and numbers. According to a teacher's interest, additional data might also be filed with a score sheet, such as the amount, character, and recency of the instruction given the children in various phases of the test, the condition of the room in which the test was taken (temperature, humidity, ventilation, illumination), what kind of work the children had previously been doing during the day on which they took the test, the method of conducting the test (directions given, helps, if any, amount of time, etc.), who conducted it, and for what purpose.

This morning I showed you a scale for some problems in arithmetic. I shall now take up the subject of geography. I have already told you something about the selection of the questions, and they form part of the material which you have in your hands (see Appendix). There were 20 questions in the March test and the same number in the June test. The scale, therefore, for geography, shows 40 questions. The appropriateness of the test material from the point of view of the difficulty of the questions may be judged by the extent to which the surface of frequency for each of the grades corresponds to the so-called normal surface.* You will gather from these diagrams that improvement in geography from grade to grade is not great. Such is indeed the case. Since the median for the lower seventh

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*At this point diagrams were shown in which was given, for each grade, the percentage distribution of pupils answering correctly no questions, one question, two questions, etc. These diagrams are not reproduced here. Attention was called to the almost ideal character of these surfaces of frequency. The medians were as follows: For the lower seventh grade, 10.75 questions; for the upper seventh grade, 11.12 questions; for the lower eighth grade, 12.17; and for the upper eighth grade, 13.76.

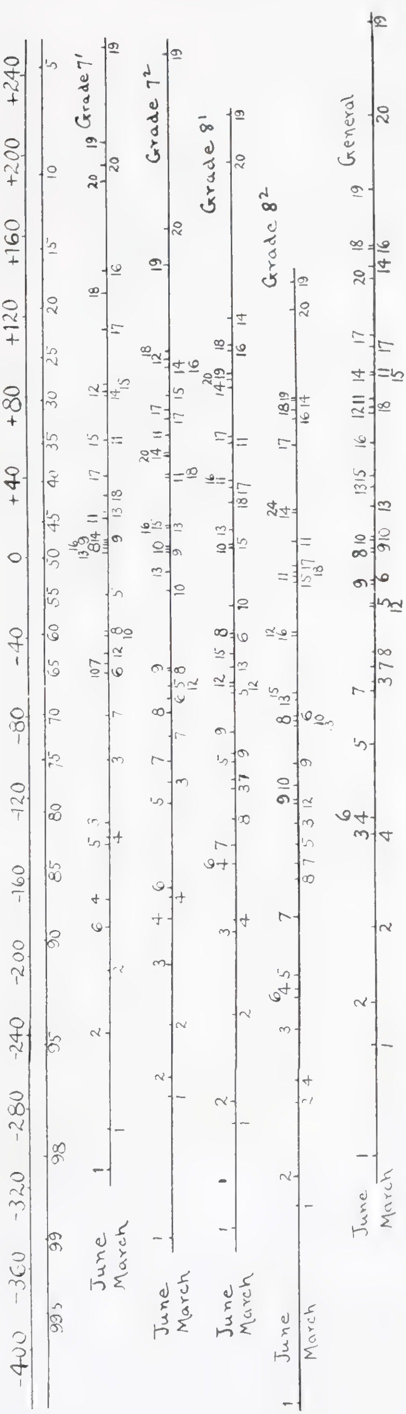

FIG. II. SCALE FOR DIFFICULTY OF FORTY QUESTIONS IN GEOGRAPHY.

grade is 10.75, and that for the upper eighth grade is 13.76, it appears that the added year and a half of school life have enabled the children of the upper eighth grade to answer, on the average, just 3 more questions correctly out of these 20.

The diagram which I show you here (Figure II) is the scale for the difficulty of 40 questions in geography. I take it that you are more interested in the scaling of the content subjects, or something from the content subjects, than you are in anything else that I could offer to you, and I am quite sure that nothing that I could give you would be newer or more original material. I am sorry that this picture does not show up better on the screen. In respect to the amount of material (40 questions), it is the best scale I have to offer this afternoon. The easiest question is located here on the general scale (indicating); it is question number 1 of the June test. The question is, "In what country is London?" In the lower seventh grade the same question also appears as the easiest; 98.2 per cent of the children answered it correctly. This places it on the P.E. scale at −311. This question number 1 of the June test, you can see, is a little to the right of 320, or towards zero. You will also note that this 98 per cent figure (indicating on lower series) is also regarded in the placing of the question, because, as I said a moment ago, 98.2 per cent of the children got this question right.

Notice how this question runs. It is, as I have said, the easiest in the lower seventh; again, it is the easiest in the upper seventh; again, in the lower eighth, and consistently, in the upper eighth. Consequently, it becomes the easiest question when all grades are considered, as the general scale shows.

You understand that these figures along here, the upper figures on each scale, represent the June questions; the lower figures represent the March questions. The hardest question was number 19 of the March test. The question reads, "South of the equator, in what direction do the trade winds blow?" This nineteenth question of the March test is located, for the lower seventh grade, right here where I point, having been answered by about 4 per cent of the children, which gives it a position at +254, according to the P.E. values. You can see that it is also the farthest question to the right (and hence the hardest) for the upper seventh; it is likewise the hardest for the lower eighth; and again, for the upper eighth, consequently, of course, for all combined.

You have no doubt noticed that while the first June question is always the easiest question, and while the nineteenth March question is always the hardest, there is not the same permanence of station for the intermediate questions. As I pointed out in considering the arithmetic scale, an ideal arrangement of the questions would be such that parallel lines might be drawn connecting each series of points for the same question. Now, altho this ideal arrangement is apparently not at all closely approximated, there is, nevertheless, a substantial permanence of arrangement, in the sense that the easiest question in one grade tends to be the easiest in any other grade, the next to the easiest in one grade tends to be the next to the easiest in any other grade, and so on. This tendency is not easily seen in the diagram unless you scrutinize it carefully. It is so strongly present, however, that the correlation coefficient between the ratings of the March questions for the different grades, as obtained by the "Foot Rule" method, is in no case less than +0.90, and in 2 of the 6 possible pairings it rises to +0.99. This means that the test value of a question in the lower seventh grade is essentially the same in each of the other grades. The hardest question remains the hardest question, the easiest question remains the easiest, and the questions which rank between tend to hold their positions for each grade in the order of difficulty. So strong is this tendency that for the March questions there is an exact correspondence thruout the 4 grades in 5 of the 20 instances. Between consecutive grades there is an exact correspondence in more than half the cases, and in no case is the rank-difference of a question more than 6. Question number 6, located here at −59 P.E. for the lower seventh grade (indicating), is the sixth in order from the left; that is to say, it is sixth in point of difficulty for that grade. The question is: "Name a leading State of the United States in the production of cotton." In the upper seventh grade it is likewise sixth in order of difficulty. In the lower eighth grade, however, you will find by counting along the scale that it is eleventh in difficulty, while in the upper eighth grade it is twelfth. Why it should be more difficult, grade considered, for an eighth grade child to name a cotton State than for a seventh grade child, I do not know.

It would be interesting to go over these questions in detail, comparing their importance and test value for each of the grades. I am afraid if I tried to do this, I should only succeed in being confusing and I am sure I should consume time. Median questions, however, are so significant, and may so easily be selected from the scale that I shall call your attention to some of them. The reason why median questions are interesting is that they reveal something concerning typical grade ability. In this sense, question 5 of the March test, located here, may be selected for the lower seventh grade. A child who is able to answer it shows, so far as one question can do so, an ability which is at least that of the midmost child of the lower seventh grade. The fifth question is, "Name a railway system connecting New York and Chicago." Fifty per cent of the lower seventh grade children in New York City can answer that question.

It will readily occur to you that some of these questions have a local significance; that perhaps 50 per cent of the children in Wisconsin, Montana, or Utah wouldn't be able to do that. The great majority of questions in the geography scale, however, are quite independent of such local conditions. As a matter of fact, when we have the equipment of scales that we desire, local geography will have its own local scale.

Another lower seventh median question which you may note on your list, if you care to, is number 8 of the June test: "What river forms a portion of the boundary between Europe and Asia?" This is a question, for instance, which is quite independent, I should say, of any locality in the United States. Number 9 of the June test is likewise a median question, "What circles bound the torrid zone?" Also number 13, "Name an important city on the Danube River"; number 14, "What State is south of Utah?" and number 16, "Name an important city on the Clyde River." All these questions appear to require at least typical lower seventh grade ability to answer them; and they appear also to be as likely to do so in one school as another so far as its location is concerned.

For the upper seventh grade, from the March test, the ninth question is one which only half the pupils can answer. The thirteenth question is also not far from the 50 per cent mark, as you can see. About 45 per cent of the upper seventh grade children can answer the question "From what is latitude reckoned?" For the upper seventh grade, from the June test, the tenth and thirteenth are likewise median questions. For the lower eighth grade, the fifteenth question from the March test is a median question. For the upper eighth, such questions are the eleventh, seventeenth, and eighteenth from the March test; and the eleventh from the June test.

It is interesting to note that some of the questions in geography are not answered correctly by as many children in higher grades as in lower grades. This is, of course, not generally true, but is sometimes true and ought to be pointed out. If more participants took part in the test and if a larger number of cities were represented, some of these irregularities would doubtless disappear. The amount and recency of instruction has something to do with the fact that the figures for these questions do not progress regularly from one grade to another. Probably the best plan would be for us to coöperate in the further testing of these questions, and if, after results have been obtained from a considerable number of participants, some of these inversions do not disappear, to reject these questions from further consideration. I am sure that even with geography, where this feature appears to be most prominent, it would not be difficult to scale 100 to 150 entirely satisfactory questions out of the 180 which I have on hand.

It will readily occur to you that in all these subjects and perhaps particularly in geography, the value of the scale will be diminished in proportion to the number of times it is used. It represents present conditions for schools in New York which are thought to be fairly typical. The best remedy for overcoming the difficulty due to familiarity with the scale is to enrich it with a great number of questions, to such an extent that familiarity with the scale will come to mean familiarity with the subject itself. When this condition is brought about, the usefulness of the scale will have been abundantly demonstrated. It will not cease to have value because children will not learn all the questions (we need give ourselves no uneasiness about that), but it will need readjustment to changed conditions.

It is a curious thing how little effect instruction has, sometimes, on matters of this kind. Did you ever give the Binet test to children who had been coached for it? If you have, you know how little good it did them. The effect of the most careful instruction is by no means to secure a perfect response. If such were not the case, words like "believe" and "receive" would not be misspelled by 50 per cent of fifth grade children, nor the word "separate" by 50 per cent of seventh grade children. Everybody knows that the word "separate" is a catch word, a hard word, and every teacher teaches it as such, and yet children continue to miss it, until, as it seems, they have reached a certain maturity or have a sufficient need for it to ensure its accurate use.

I have a great more material in hand for a geography scale than is shown here. I have returns from 180 questions of which these 40 are a sample. If any of you care to see some of the rest of the questions, I shall be very glad to show them to you, and also to tell you how hard they are. The material, however, is so voluminous and it has so lately reached my hand in usable form that it will probably be several months before I shall be able to present it. Even then, the number of participants for many of the questions will be too few to be ideal.

For questions which I am showing you today, however, the number of participants seemed to me to be sufficient for practical purposes. There were tested in each of the subjects about 3,000 in the lower seventh grade, 2,700 in the upper seventh, 2,300 in the lower eighth, and 2,000 in the upper eighth; a total of about 10,000 children. I say "about" because the number varied a little as between subjects.

The general scale for geography is an attempt to answer, without reference to any particular grade, this question: What is the difficulty of each question? Observe that the percentages shown in the upper line here have no reference whatever to the general scale, but only to the four grade scales. The P.E. values are the only ones that govern in the bottom scale. It will be interesting to note some of the uses which may be made of the general scale considering the June questions only. Pupils may be given these questions arranged in the order of their difficulty from 1 to 19, as follows: 1, 2, 3, 4, 6, 5, 7, 9, 8, 10, 13, 15, 16, 12, 11, 14, 17, 20, 18, 19. Pupils may be given the questions in that order and directed to answer them in that order. By being able to answer number 1 of the June test, "In what country is London?" a lower seventh grade child merely shows that he is not the poorest or the next to the poorest child among 100 pupils of his grade, taken at random. This is true from the fact that 98 per cent of the lower seventh grade children can answer this question correctly. Therefore, if he answers it, he only shows that he is among that 98. He is not the ninety-ninth or one-hundredth; that is, he is not the poorest or the next to the poorest.

By answering the second question, "What is the capital of the United States?" the same pupil would show evidence, as far as this question can show it, that he is not among the 5 poorest pupils among 100 selected at random from the lower seventh grade.

Similar statements could be made concerning the succeeding questions along the scale. By answering question 7, "Name the zones into which the earth is divided", he would show that he belonged among the upper three-quarters of the seventh grade, second half. By being able to answer the thirteenth question, he would show an ability which is practically typical of all the grades except the upper eighth. For that grade, he would barely escape being in the lower 30 per cent, because the thirteenth question is right here (indicating) for the upper eighth grade, that is, it is just about at 70 per cent. This means that 70 per cent of the children can answer it, and by answering it the child just escapes being in the lower 30 per cent.

In any use of the general scales, whether in one subject or another, we must provide for handling the problem of children who fail on easy questions and answer hard ones, in other words, for the children who do not answer all the questions of our general scale up to a certain point, and then fail altogether. We know in the Binet test, for instance, that children will answer questions up to a certain point, or do the things required of them up to a certain point, and then they will make one or two failures, and then a few successes, interspersed with failures and successes, for a little way beyond.

The present scoring method takes account of this. About the same plan would do here. Briefly, I would say this: I would give a child credit on the basis of what the P.E. values are for his continuous performance up to the point where he quits. Suppose he answers his first, second, and third of the geography June test; that brings him to −150. Take that as a point of departure and add his success from that out, and the result will place that child. as, say, a typical 7-A child, or a typical 7-B child, or among the first 25 per cent of the seventh grade, or whatever plan you adopt for purposes of classification. It is a rather simple matter to handle. The point is that the P.E. values of the upper part of the scale give an absolute rating which you can use. The per cents do not.

If you should wish to use questions in geography which differ in difficulty by about equal amounts, selections from this general scale may be made by choosing a series of points such that the distances between those that are consecutive are about the same. Such a series of questions, from the June test, would be: No. 1, at −305, "In what country is London?" No. 2, at −222, "What is the capital of the United States?" No. 3, at −138, "Name the six continents"; No. 7, at −68, "Name the zones into which the earth is divided"; No. 10, at +9, "Name a leading State of the

United States in the production of wheat"; No. 11, at +79, "For what industry is Pittsburg noted?" and No. 18 at +155 "Name three public buildings in Washington, D.C." The steps between consecutive questions in this series average 0.77 P.E., and none of the steps are larger or smaller than the average by any considerable amount.

In history, 12 questions were given in March and 12 questions in June. A diagram showing the distribution of individual ratings would indicate an approximately normal surface of frequency. As in the case of geography and arithmetic, the test material appears to have been adequate for the purpose, since it was not so difficult that the less capable children could not accomplish something, nor so easy that the brightest children were able to do all of it. The median for the lower seventh grade in the March test is about 4⅛ questions correct per pupil; that for the upper seventh grade is about 4½ questions; for the lower eighth grade it is 6¼ questions, and for the upper eighth grade about 7⅔ questions. All these medians are in terms of questions correct out of a possible 12.

This (Figure III) is the scale for history. The plan for placing the questions is the same as it was for arithmetic and geography. The total extent of the scale is from question 1 of the March test, "In what war was the battle of Gettysburg fought?" which was answered correctly by more than 90 per cent of the children in each of the grades, to question 7 of the March test, "Under whose administration was the Civil Service Commission established?" and question 12 of the March test, "To what political party in England did most of the settlers of Virginia belong?" Each of these two questions was answered correctly, on the average, for all of the grades, by about 14 per cent of the children.

Median questions in history for the lower seventh grade are, from the March test, No. 2, "At about what time was the first message sent by telegraph?" No. 5, "State one important general plan carried out by the navy of the North in the Civil War"; and No. 10, "In general, what was the attitude of England toward the South during the Civil War?" From the June test, question 4, "In what year did government under the Constitution of the United States begin?" and question 11, "Give the substance of one amendment to the Constitution made as a result of the Civil War", are likewise median questions for the lower seventh grade.

Without reading the questions, I may indicate as median questions for the upper seventh grade, No. 2 from the March

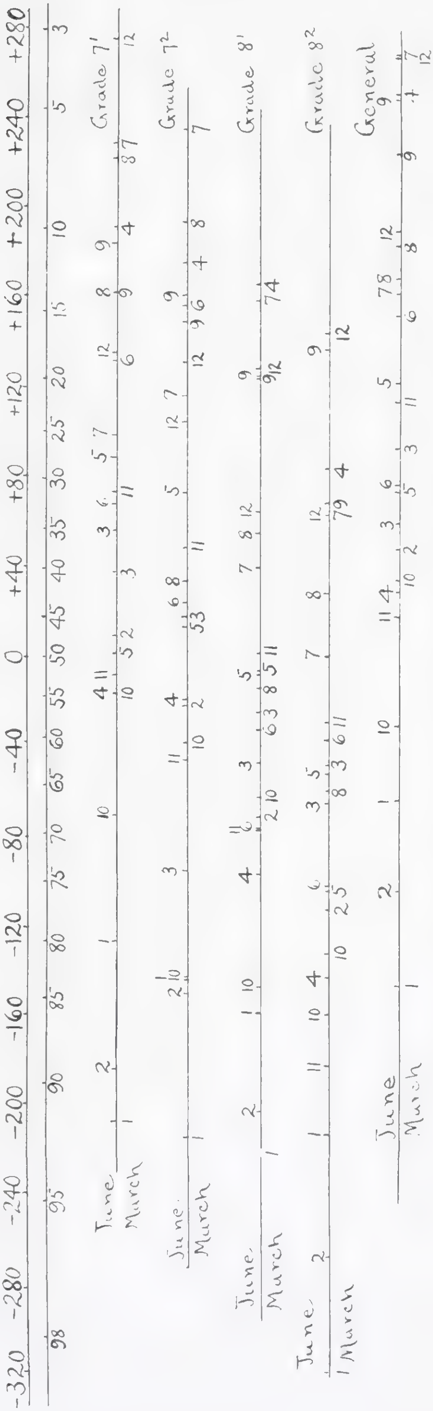

FIG. III. SCALE FOR DIFFICULTY OF QUESTIONS IN HISTORY.

test and No. 4 from the June test; for the lower eighth grade, Nos. 3, 5, 8, and 11 from the March test, and No. 5 from the June test. For the upper eighth grade No. 7 from the June test is a median question to a hair, and No. 11 from the March test is approximately a median question.

In grammar, two tests were given, one to the lower seventh grade, consisting of 10 questions, and one to the grades above the lower seventh, consisting of 14 questions. The results from these tests were not as satisfactory, so far as yielding a type of distribution approximating the normal surface of frequency is concerned. The test was too difficult, altho the distribution is quite as good as that of many tests from which important conclusions have been drawn in the field of experimental education.

The scale for grammar (Figure IV) shows the placing of 38 different questions. Fourteen were given both in March and June to the upper seventh, lower eighth, and upper eighth grades; 10 questions were given, both in March and June, to the lower seventh grade; but in each case 5 of these were the same as those given on the test of the upper grades. This leaves but five questions on each of the lower seventh grade lists in addition to those used in the upper grades. The scale for grammar shows the lower seventh grade independently of the others. You have in your hands the March and June lists of questions for the lower seventh grade, and you also have different lists of questions for the remaining grades, one for March and one for June. The numbers on these scales refer to those questions.

The hardest question for the lower seventh grade was the seventh from the March test, located here (indicating on scale). The question is, "Give an example in a sentence of the positive degree of the adverb 'better' and underline it." This question was answered by only 6 per cent of the lower seventh grade children. The easiest question for this grade was number 4 from the June test; and yet only 62 per cent of the children were able to answer it correctly. The question was "Underline the subject word once and the verb twice in the following sentence, 'The cold November rain is falling.' "

The nearest approach to median questions for this grade is found in questions 2 and 3 from the March test. You can mark them as median questions if you care to. In the grammar test for grades from the upper seventh to the upper eighth, the scales show that most of the questions were found to be too difficult. In the upper seventh, out of a total of 28 questions, there were

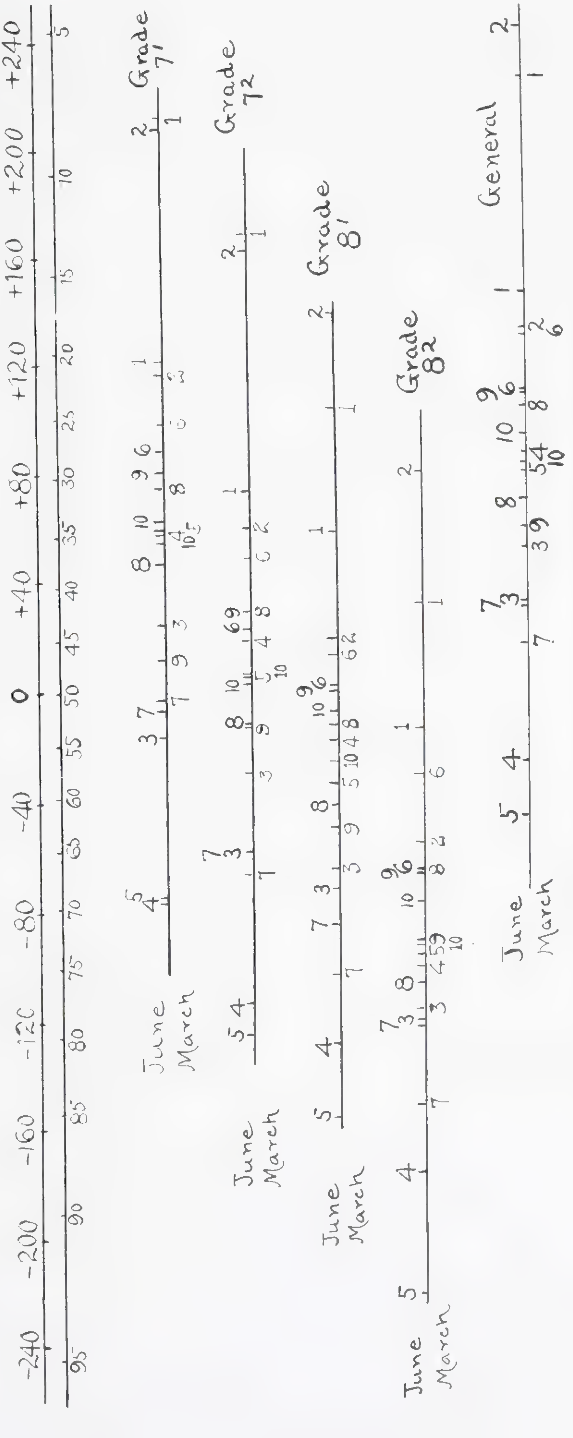

FIG. IV. SCALE FOR DIFFICULTY OF THIRTY-EIGHT QUESTIONS IN GRAMMAR.

25 questions, each one of which was answered correctly by less than one-half of the children. For that grade, the hardest question (only 2 per cent correct) was No. 10 from the June test. The question was, "Change the following complex sentence into a simple sentence, without altering its meaning: 'We saw that it was wise to give in.' " The easiest question (61 per cent correct) was number 13 of the June test: "Give an example in a sentence of an adverb of time, and underline it." In the lower eighth grade every question in the March test was answered correctly by fewer than 50 per cent of the children; and of the 14 questions in the June test, 9 were answered by fewer than 50 per cent of the children.

The test in grammar did not prove to be altogether satisfactory. A great many principals are doubting the wisdom of the teaching of formal grammar in the grades, and altho it is in the course of study in most cities, I fancy it is not being stressed as much as it used to be, or as is necessary for making a good showing on a test. We all know that the question of teaching formal grammar in the elementary school is being debated, and that those who are opposed to its place in the curriculum appear to be making out a good case. I doubt if I should have included a test in grammar as a test in one of the fundamental subjects, if I had not been particularly requested to do so. I should like to try these questions in the high school.

In the material which you have in your hands I have included a tabular showing for each question of all the subjects and the percentage of pupils who answered it correctly. In this tabulation all grades are combined. In the absence of further information about these questions, this tabulation may be taken as indicating a standard based on actual returns. If you give any of these questions to pupils in your own schools, it will, no doubt, be interesting for you to compare your results with this tabulation.

Before concluding this report I should like to give you a brief statement of the manner in which the general scales for each of the subjects were constructed. You will remember that in each of the diagrams giving the scales there was a line at the bottom on which was shown the arrangement of questions, irrespective of the grades. The method of constructing the general scale is rather straightforward, and anyone can employ the method without much technical knowledge.

In the first place, a double entry score sheet, such as I showed you at the beginning of my talk this afternoon, is necessary, because we can get from it both the question results and the personal or individual results. For the grade scales, all you need are the question results. When you know the number of children in each of the classes concerned who answered a given question correctly, all you have to do is to add these together and find the total number of participants, getting the per cent that the number of correct answers is of the total participants. This per cent value is to be transmuted into a value in which the variability of a normal surface of frequency is the unit. For this purpose we may use as our unit the probable error or the average deviation or the standard deviation. I have used the probable error because it is easy to define. It is an amount of ability above or below the median such as to include half the total number of ratings. In a normal distribution, if we arrange all the participants in the order of their ratings, and if we count, from the beginning, one-quarter of the way and three-quarters of the way, half the difference between the measures which we reach is the probable error.

The next thing to do is then to transmute the per cents into units of the probable error. For that you will simply need a table; I have published one in my study of spelling, and Dr. Thorndike has an abbreviated one in his "Mental and Social Measurements". As soon as you have these P.E. values, you mark them off on a horizontal line. In placing a question on a general scale, the essential things to know are: first, the placings of the questions on the grade scales, and, second, the intervals between the medians of each of the grades. For the general scale, any convenient point of reference may be taken and arbitrarily called zero. I have always used the median of the lowest grade in the series of grades to which the test was given. When such is the case, add to the value of a question for each of the higher grades the interval at which each grade median stands above the median of the lowest grade. To illustrate: The first question in arithmetic in the March test was answered by children in such a way as to be placed at +2.13 P.E. for the lower seventh grade, at +1.69 P.E. for the upper seventh grade, at +1.04 P.E. in the lower eighth grade, and at +0.32 P.E. in the upper eighth grade. To obtain the placing on the general scale, it will be necessary to add to +1.69 P.E. the distance between the medians of the upper and lower seventh grades. This difference amounted to 0.66 P.E. which, when added to 1.69 P.E., gives 2.35 P.E. as the distance above the lower seventh grade median, according to the record made in the upper seventh grade. The placing of this question for the lower eighth grade was, as I have said, + 1.04 P.E., with reference to the median of that grade. To refer this placing back to the median of the lower seventh grade, it will be necessary to add to 1.04 P.E. the interval between the median of the lower seventh and the median of the lower eighth grade. This I found to be 1.20 P.E. Adding this to 1.04 P.E. gives 2.24 P.E. as the placing of the question with reference to the lower seventh grade median, and according to the lower eighth grade record. The interval between the upper eighth grade median and the lower seventh grade median is found to be 2.06 P.E. When this amount is added to 0.32 P.E., the result is 2.38 P.E., as the placing of the question with reference to the lower seventh grade median, and according to the upper eighth grade record. If each grade above the lowest did as much better with the problem as the median intervals would lead us to expect, the placing of the problem on the record of each grade higher than the first would coincide with the placing on the lowest grade record. This condition is hardly to be expected, and, as a matter of fact, the best placing for the general scale is taken to be the average of the four placings from the four different grade records.

I have said that it is necessary to know the median intervals between the lower seventh grade and each of the grades above it, and I have given these for arithmetic as 0.66 P.E., 2.20 P.E., and 2.06 P.E. The determining of these distances is based upon the amount of overlapping of each grade record beyond the median of the next higher or the next lower grade. I am not altogether satisfied with the method, and I shall not enlarge upon it at this point, but shall give you, without further comment, a table showing, for each of the subjects, the median distances between consecutive grades, and also the per cent of pupils in each grade who equal or exceed the median of the next higher grade. The data for all these determinations are from the March tests only.

TABLE 1—DATA FROM MARCH TESTS

OVERLAPPING							
I. MEDIAN DIFFERENCES IN TERMS OF THE "PROBABLE ERROR"				II. PER CENT IN EACH GRADE WHO EQUAL OR EXCEED THE MEDIAN OF NEXT HIGHER GRADE			
Subject	7^1–7^2	7^2–8^1	8^1–8^2	Subject	7^1 on 7^2	7^2 on 8^1	8^1 on 8^2
Arithmetic. .	0.657	0.541	0.860	Arithmetic. .	33	36	28
Geography. .	0.132	0.428	0.845	Geography. .	47	39	28
History.	0.260	1.096	0.916	History. . . .	43	23	27
Grammar. . .	?	0.498	0.827	Grammar. . .	?	38	29

The foregoing is offered as an indication for a method of analysis of test material. A few years ago it was the fashion to investigate methods of teaching, methods of organization, effects of fatigue, and the efficiency of individual teachers, without reference to the nature of the test material. The result was exceedingly confusing. No sooner did we reach a conclusion than we found ourselves in conflict with a different conclusion, equally authoritative. The whole matter of experimental education seemed to be in a fog.

Of late, however, it has been recognized that we are not in a position to investigate these attractive questions until we have taken the trouble to analyze the material which we use. A great deal still remains to be done, but so much has been accomplished that it offers a promise and a prophecy for a much more complete and systematic understanding of educational conditions. No doubt it is much more attractive to compare teaching methods than it is to evaluate and standardize, but the latter work must be done first. We must creep before we can walk.

In conclusion, therefore, I revert to the position which I took in the beginning, namely, that coöperative effort is the only means by which an abundant and satisfactory standard material can be obtained. No one person and no small group of persons can cope with the situation. The results which I have given you today represent the labor of many people, over a long period of time. It is not likely that conditions so favorable will often present themselves to anyone; but if we could have some kind of an association whereby we could pool our results and have them adequately handled by persons skilled in the sort of work necessary to be done, we could soon build up, for all the school subjects, a body of material which would enrich our knowledge of school abilities and processes, and dignify the name of teacher.

Efficiency Indices

B. R. Buckingham

I am not under any misapprehension as to the degree of popularity that may be ascribed to the lecure of a statistician. Nor indeed have I of late been under any misapprehension as to the degree of his own popularity. There are some things which he must find out and know and tell folks, but which are not always agreeable to those concerning whom the information is given.

Nor is it always easy to get this information. There is a certain glamour and glittering generality about the talk of those who lead you to suppose that precision is easily attainable in statistics. This, I assure you, is not the case. The adage about the superlative degree of liars you know it —in its application to statistics has, as have most adages, a basis of truth. I know of no greater lies than those which can be perpetrated in the name of statistics, and I know of no branch of endeavor which requires more delicate handling in order to bring out the exact truth than does the business of statistics.

It is, at the outset, difficult to get information which is reliable. This is not always due to the disinclination of people to furnish the facts, but is often due to their misunderstanding and what we, in somewhat hasty moods, term their "stupidity". Two and two do not invariably make four.

The simplest direction which you can give to people is not so simple but that it will be misunderstood and evaded by some. I had occasion to get out a service card in New York City some time ago; each teacher was required to make out a card, and the first item on the card was the teacher's name. It never occurred to me that there could be any difficulty about Item 1, altho I did write a direction concerning it because I wanted to file the cards in an alphabetical arrangement and therefore desired to have the last name appear first on the line devoted to the name of the teacher. I therefore took the trouble to write a direction on the back of the card in this manner: "Item 1. Write your last name first."

Several hundred cards came back with the given name written first. I sent these cards back, pointing out the error and asking that they be made out in conformity with the direction for Item 1. Even then, one teacher sent in her card with the given name written first. I sent for the teacher, and placing the card and the directions before her, asked her to read the first direction and she read it as follows: "Item 1. Write your last name first." "Now," I said, "do it." Complying with my request, she wrote her last name first but placed it toward the right-hand end of the line. Afterwards she filled in her first name at the beginning of the line.

The conversation that ensued was one in which she had the best of it. She said that she had written her last name first, and when I said that of course I meant to have the last name written in the first position, she asked me, "Why didn't you say so?"

The matter of school reporting has grown to be one of prodigious importance. It has developed from very small beginnings to proportions where in each of the more advanced cities a large staff of people is employed. Special reports are likewise devised to supplement the regular report; and of late we have the school survey—a form which is becoming conspicuous in the development of educational reporting.

The purpose of city superintendents, however, has been the same from the beginning, namely, to give to the interested public information concerning the efficiency of the schools for which their reports were rendered. Aside from the descriptive part of such reports, the facts concerning registration have been given from the earliest days. The mere size of the school system was properly felt to be an important indication of the extent to which the schools were carrying out the purposes for which they were organized. When, at a later date, the facts concerning registration were related to the total population of the area to which the schools belonged, or to the population of school age, a considerable improvement was made in the matter of school reporting. At an early date, also, city superintendents began to report figures showing the number of pupils in attendance, and when these figures were related to registration figures, they became a standard element in school reports.

After a graded system had become well established and refinements had been introduced, the feature of reporting facts as to promotion became general. Subsequently, an effort was made to relate promotion facts to registration facts in much the same way that a relation had previously been shown between attendance and registration.

Again, within the last five or six years, it has become common for school reports to contain facts concerning the ages of children with respect to their grades.

These four steps in reporting, namely, the showing of registration, attendance, promotion, and age in relation to grade, constitute progressive steps in the method of reporting, whereby a city superintendent offers an appraisal of the school system of which he has charge.

Running parallel with these four kinds of reporting, there also appears in many reports a showing as to the economy with which the school system is administered. This showing has been developed in some quarters to a remarkable degree of precision. It has taken the form of statements of unit cost based on cost per pupil hour, cost per $1,000 of assessed property, and cost per capita of population. As a further indication of economy of organization, such facts have also been reported as average size of class, or ratio of the number of teachers to the registration.

All these elements of reporting have value as indicating the efficiency of the school organization from the administrative point of view. They leave untouched the quality of the teaching; nor are we to suppose that any system of schools is adequately reported even when all these elements are shown. They do, however, constitute a physical basis of school efficiency, and as such they are valuable and necessary.

I propose, therefore, to show for each of these classes of facts what I consider to be the best method of gathering the information about them and reporting it effectively. It is clear that if we can all use the same method, we shall gain greatly thru the opportunity for comparison as between schools and school systems. Comparisons may be odious, but nothing is more stimulating toward improvement in organization than the knowledge that comes from relating local conditions to conditions in other places. Comparisons between classes, between schools of the same system, and between systems, cannot be neglected, and, indeed, they lose nearly all their odium when standards are expressly stated in objective terms, and the comparison is instituted in such a way that personality plays no part. But the most effective of all comparisons is the one which compares the present attainment of an individual school or of a group of schools with the past attainments of the same school or group of schools. A systematic analysis carried out on this basis is productive of good effect. Effort with knowledge of results has been demonstrated to be far better than effort without knowledge of results.

The general principle which underlies the statement of facts as to attendance, promotion, and age is to *show actual conditions in relation to possible conditions.* This principle leads, generally, to the percentage form of statement. Specifically, we express the ratio of the number of children in attendance to the greatest possible number who could have attended, i.e. to the register or number belonging. Or, we express the ratio of the actual number of promotions to the greatest number of promotions that could have been made. Or, finally, we express the ratio of the number of children at age or younger to the entire number of children belonging.

The matter of attendance presents little difficulty. Remembering the principle that we are to express the ratio of actual to possible conditions, we shall first find out what the actual attendance is, and, second, what the greatest possible attendance might have been. On any given day, for a given class, the attendance is an objective fact which is easily ascertained. The registration of the class is equally well known, and the ratio of attendance to register for that day and for that class. To express the same fact for the class over a period of a week or a month or a year, it is only necessary to add the attendance for each day and the registers for each day of the period in question, and to divide the first sum by the second. What is done for a class may also be done for an aggregate of classes comprising a school, or for an aggregate of schools comprising a school system. In each case, the first term of the ratio should be the sum of all the daily attendances for the group in question, and the second term should be the sum of all the daily registers for the same group.

The procedure, therefore, is exceedingly simple. It is not always carried out, however, in the manner indicated. In not a few city reports, average attendance is expressed as a percentage of average register. This is always bad in theory and may be decidedly misleading. In any system there are almost always creations of new classes during the school year and consolidations of old ones, and, in very large systems, entire schools are sometimes created or discontinued. The average attendance of a class or school which has been discontinued and which, consequently, has been in session only a portion of the year, is based upon a less number of days than the number of days in the school year. The same is true of classes or schools created during the year. If the aggregate attendance of a class which ran for the first 25 days of the school year was 1,000, the average attendance would be 40. For the same class, the average register might have been 45. In arriving, however, at the attendance rate for the school or school system in which the class belonged, it would not be proper to use 40 and 45 as elements in arriving at the average attendance and register. The only safe way to compute the attendance rate is to ascertain the aggregate days of attendance for the group in question and to divide it by the aggregate days of register of the group for the given period.

Attendance as a criterion of efficiency is of fundamental importance. It is, to be sure, obscured by later refinements in our more highly developed school systems; but even in them its importance is clearly, altho perhaps tacitly, assumed; while in less highly developed systems it often becomes the most significant discoverable fact. In the Maryland survey the authors made no more effective presentation of the insufficiency of the State school system than that in which they showed the small amount of school attendance. Other and more refined measures of efficiency were often lacking, but when it was shown that the attendance rate on total enrollment was 52.8 per cent in 1880 and 65.3 per cent in 1914, abundant evidence was afforded on the one hand, that improvement had been made, and, on the other hand, that conditions were "still poor". From this fact alone we are prepared to find, as indeed we do find in other parts of the Survey, that conditions in general indicate substantially the same improvement and the same present inferiority.

Again, when comparison is to be made among large numbers of systems, facts as to attendance are among the few bases—apart from financial ones—upon which comparison may rest. In "A Comparative Study of Public School Systems in the Forty-Eight States", the Division of Education of the Russell Sage Foundation made a very effective presentation based mainly on data contained in the report of the Commissioner of Education for 1911. Attendance was one of the facts considered. At the close of the report, the 48 States were given a general rank and also a rank in each of the ten most important educational facts already considered. Attendance was again included, and its importance as a single criterion may be judged from the fact that the ranking of the States on attendance and their general ranking in the "ten tests of efficiency" was such that the correlation coefficient was +0.67 ("Foot-rule" method).

The attendance rate is not, as I have said, always computed in the same way. In the bulletin of the Russell Sage Foundation the attendance rate was taken directly from the report of the Commissioner of Education where the rate is based not on register but on enrollment—that is to say, it is based on the total number of different children who attended school any portion of the year. Now, there are a great many children who enroll and drop out and a great many others who do not enroll until the school year has more or less advanced. In a school system where semiannual promotions take place, all mid-year graduates and all mid-year entrants belong to the school but half the year. If their attendance were perfect, it would be but 50 per cent of the number of school days in the year. Correspondingly, perfect attendance of all pupils on register a portion of the year would be represented by a per cent less than 100. The method of basing the attendance rate on enrollment ignores the fact that 100 per cent should represent the maximum possible condition. In this method, 100 per cent does not represent anything which can be defined. Stating my criticism with reference to the principle I have already laid down, an attendance rate based on enrollment (total number of different children attending any portion of the year) fails to express the ratio of actual to possible conditions.

The attendance rate as an index of efficiency may appear to you of doubtful validity. It may be thought that local conditions affect the attendance rate in ways that cannot be ascribed to administrative efficiency. For example, small schools and small classes may be thought to be favored in securing high rates of attendance. In such schools, principals and teachers know the pupils intimately; they commonly know their parents also; they are more or less acquainted with their home conditions. Such knowledge is desirable from every point of view, and might be expected to operate to the advantage of attendance, without the result being properly attributable to the character of the organization or administration of the school. Similarly, the location of a school, the economic status of the community, the prevailing nationality, the average distance of home from school may be thought to have bearing upon the question of attendance, in ways that make comparisons between schools difficult or unfair. The investigations, however, which have been carried on in the measurement of abilities in school subjects suggest that all such factors are likely to be of less importance than they would be thought to be upon *a priori* grounds. The fact is that supervision, administration, and organization are words which are assuming progressively greater importance in school matters. "As the principal is so is the school" is more than an epigram.

So far as I have studied the question, it seems to me that the schools in any given school system may properly be compared on the basis of attendance, whatever the factors with respect to location, size, or community conditions may be. In particular, with reference to size, large schools seem to be quite as likely as small schools to have a high rate of attendance. In New York City there were 478 elementary school organizations at the close of the year 1914-15. The registers of these schools ranged from 22, for a one-room building in a rural section on Staten Island, to 4,488 for a huge organization in a thickly settled district in the borough of the Bronx. The attendance rate of the former was 91 per cent; the attendance rate of the latter was likewise 91 per cent. The average attendance rate for schools of less than 200 pupils was 88.0 per cent; that for schools of 201 to 400 pupils was 87.6 per cent; and that for schools of 401 to 600 pupils was 89.5 per cent. I have classified the schools, according to size, by steps of 200. The rates for these groups reach a maximum for the 1,201 to 1,400 groups, where the rate is 91.4 per cent. There is a slight falling off in the rates for the very large schools. In general, however, it may be said that instead of the small schools being favored in the matter of attendance, the large schools tend somewhat to have the higher rates. This is probably due to the factor of supervision. There is a tendency for large schools to be in the hands of competent principals.

The relation, however, between attendance rates and sizes of schools is best represented by the correlation coefficient, some steps in the derivation of which I shall now show you.

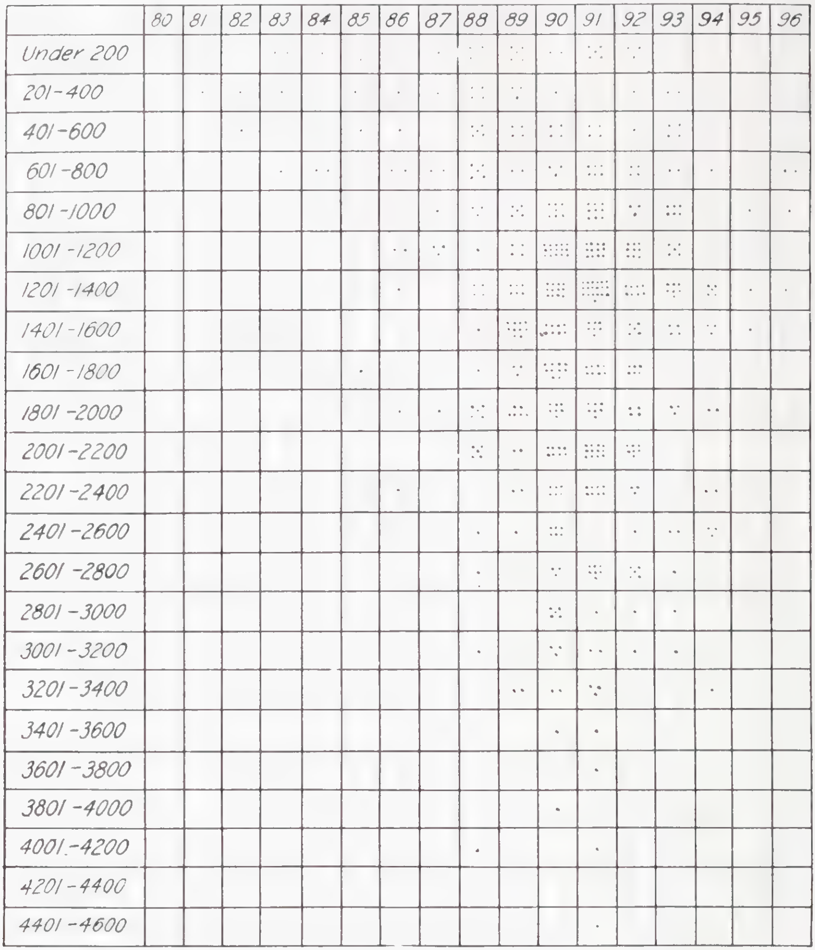

FIG. I. CORRELATION OF ATTENDANCE RATE WITH SIZE OF SCHOOL. (Horizontal scale is for attendance rates; vertical scale is for registers of schools.)

This chart (Figure I) gives a scatter diagram of the 478 schools in New York City to which I have referred. Each dot in the diagram stands for a school whose size is indicated by the line caption and whose attendance rate is indicated by the column caption. The extent to which the dots show a tendency to range from the upper left to the lower right corner of the diagram indicates the extent to which rate of attendance and size of school vary together. I think you can see from the grouping that there is a slight tendency for the dots to arrange themselves in this way.

	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	
Under 200				2	1	3		1	4	5	2	5	3					26
201 - 400		1	1	1		2	1	1	4	3	1		1	2				18
401 - 600			1			1	1		5	4	4	4	1	4				25
601 - 800				1	2	1	2	2	5	2	3	6	4	2	1		2	33
801 - 1000								1	3	5	7	9	3	6		1	1	36
1001 - 1200							2	3	1	4	15	12	9	5				51
1201 - 1400							1		4	6	12	19	8	7	5	1	2	65
1401 - 1600									1	10	8	7	5	4	3	1		39
1601 - 1800						1			1	3	10	8	6					29
1801 - 2000							1	1	5	8	7	7	4	3	2			38
2001 - 2200									5	2	8	12	7					34
2201 - 2400							1			2	6	8	3		2			22
2401 - 2600									1	1	6		1	2	3			14
2601 - 2800									1		3	7	5	1				17
2801 - 3000											5	1	1	1				8
3001 - 3200									1		3	2	1	1				8
3201 - 3400										2	2	3			1			8
3401 - 3600											1	1						2
3601 - 3800												1						1
3801 - 4000											1							1
4001 - 4200									1			1						2
4201 - 4400																		
4401 - 4600												1						1
		1	2	4	3	8	9	9	42	57	104	114	62	38	17	3	5	478

FIG. II. CORRELATION OF ATTENDANCE RATE WITH SIZE OF SCHOOL. (Horizontal scale is for attendance rates; vertical scale is for registers of schools.)

This chart (Figure II) shows the same facts, except that figures replace dots in the squares. You can see from the totals the distribution of the schools with respect to size. The average size of school is 1,467 pupils. That is, it is in the 1,401 to 1,600 group (indicating). There is no mode or most frequent measure at this group, there being only 39 of the 478 schools whose registers fall between 1,401 and 1,600. From the number of groups (23 in all) and from the frequencies of these groups, you will readily see that the variation in the sizes of schools is great. The average deviation is 652 pupils. The variation in attendance rate, however, is not very great. It ranges from 81 per cent to 96 per cent. The average is 90.3 per cent; and the average deviation is 1.63 per cent.

From this chart the Pearson coefficient of correlation is found to be +0.21, with a probable error of 0.03. Altho the coefficient is low, nevertheless when taken in connection with its low probable error it is significant. The relation, tho small, is direct and it is real.

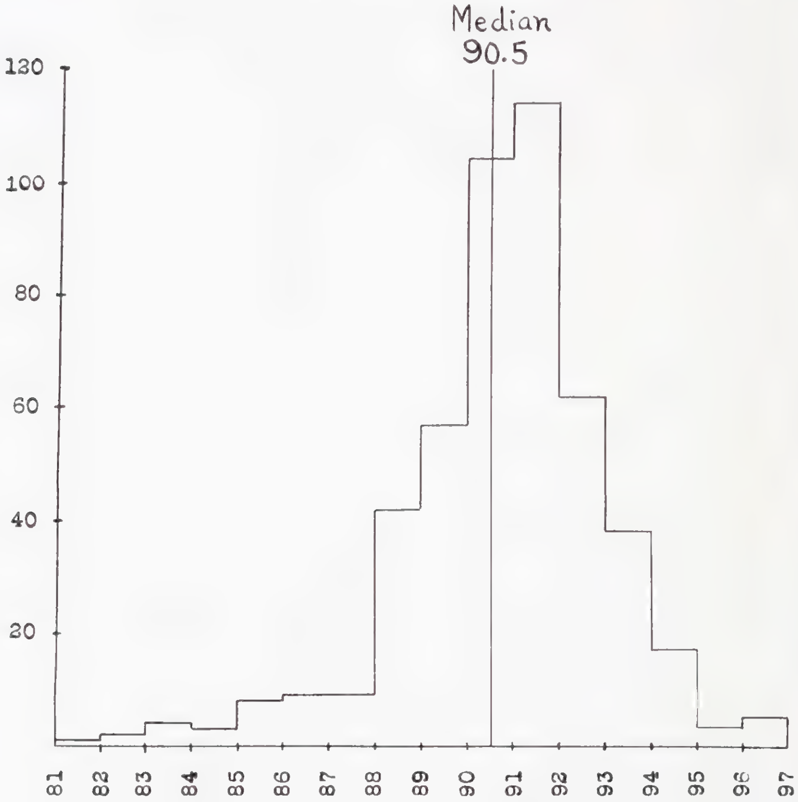

FIG. III. FREQUENCY OF ATTENDANCE RATES (478 schools).

A graphic representation of the distribution of attendance rates among 478 school organizations may be seen in this chart (Figure III). The horizontal scale is for attendance rates. The vertical scale is for the number of schools having the indicated rates. The frequencies rise slowly from a single school at 81 per cent to nine schools at 86 per cent and nine at 87 per cent. It then rises rapidly to a mode at 91 per cent, falling rapidly to three schools at 95 per cent and five schools at 96 per cent. The shape of the frequency surface is approximately normal.

I shall turn now to the second of the series of efficiency indices which I have chosen, namely, the promotion rate.

The reporting of promotion rates by city superintendents has been rather unsatisfactory, and comparison between conditions in the various cities and for various years is quite impossible, owing to the variety of methods employed. Of these methods, two may be mentioned as the most common. By the first method the ratio of the number of pupils promoted on promotion day to the number on register on that day is computed. The method has no justification, except from a statistical point of view. For the one day in question, it meets the requirement of showing the relation of actual to possible conditions. It therefore yields a figure which is valid for that day; but it totally ignores the fact that in well-conducted school systems every day is promotion day, and that an effort is made to advance children whenever they are judged to have reached a point where they can profit by the next higher grade of work. By this method all incidental promotions are neglected; and yet it is one of the surest signs of good school management when the number of these incidental promotions is large. A statistical treatment which leaves them out of account fails to include all the facts.

The second method which is commonly employed in educational reports consists of adding the number of incidental promotions to the number at the end of the term, or year, and dividing this sum by the register on the last day of the term, increased by a number equal to the number of incidental promotions. In other words, it is end-term promotions plus incidental promotions, divided by end-term register plus incidental promotions. There is absolutely no statistical justification for this method. It is true that the first term of the ratio includes all promotions, but the second term certainly does not represent, as it should, all the possible promotions. In fact, it is a figure for which there is no reality.

The method arose from the employment of an intermediate one by which all promotions occurring during and at the end of the term were divided by the register at the end of the term. By this means it frequently happened that the number of promotions was greater than the end-term register, with the result that the rate of promotion was shown to be greater than 100 per cent. It was to avoid this result that the end-term register was increased by the number of incidental promotions. The effect is not always to yield a rate less than 100 per cent, particularly when some of the pupils skip a grade at the end of the term.

The problem, however, will be considerably simplified if we take account of the principle I have stated, namely, that the relation of actual to possible conditions should be shown. In applying this principle the first attempt should be to get a report of the actual conditions. We shall need to know the actual number of promotions made. This is not difficult. But we must bear in mind that we are to show actual conditions in relation to possible conditions. How does the promotion of each child relate to what might possibly have been done? Clearly when a child is promoted, as an actual fact in relation to the best possible result that could have been obtained, it makes a great deal of difference how long he has been on register in the grade concerned. There is a slight theoretical possibility for a child to be promoted after having been a single day in a class (a day being the smallest time-unit we use in school reporting). I have known children to be advanced to the next higher grade after a day in a class. Such an advancement is scarcely a promotion in the usual sense. It hardly takes place except in the case of a newly-admitted child who was wrongly placed at first. But these things happen and they are usually called promotions in the report. My judgment is that, all things considered, they should be. It is impossible to lay down a rule as to how long a time must elapse before an advancement to a higher grade may be reported as a promotion.

It appears, then, that there is, under certain circumstances, a possibility of promotion after a child has belonged to a class one day. This possibility increases as the days go by until it becomes a strong probability for the child who has belonged to the class every day of the term. It is evident, therefore, that there is a sense in which one promotion is not equal to another promotion. The promotion of a child who has been on register two months of a term is not the same as that of a child who has been on register all the term. It is possible and quite practicable to weight each promotion by the number of days that the promoted child has been on the register of the class from which he was promoted. The effect of this I shall show you in a minute.

Meanwhile, obtaining the actual conditions will involve two things: first, the fact of promotion; and, second, the number of days of register for each child promoted.

The method of reporting in every school system should embody short-term reports—say monthly—on which the significant facts for each school may be gathered at the central office for current use. I myself have found these short-term reports to be the best source for making up the usual annual report, by so devising them that the facts required at the end of the year may be accumulated as the monthly reports come in. This method has the advantage not only of keeping data on hand currently, but it has also the added advantage of not requiring principals or teachers to make out annual reports on facts which they have already reported during the year.

Whether such a plan is in operation or not, there may be provided on the form on which the teacher makes daily entries a column or item calling for the number of children promoted from the class each day, and another requiring that, if one or more children are shown as promoted on any given day, the aggregate days of their register in the grade should be shown. The principal can then easily transfer to his report these entries for promoted pupils and aggregate days of register. Thus a statement of actual conditions is given.

The possible conditions, however, are not, in the case of promotions, absolutely definable. By admitting possibilities remote enough, an indefinite number of promotions may be regarded as possible. For a school or a school system the possible conditions may very well be represented for each child by his total days of register in the grade for the term. Advancement from one grade to the next is, from the usual point of view, an indication that the work of the grade from which the advancement takes place has been completed. This means that the child has completed as many days' work as the term contains. If he has been on the register of the grade the entire term and is promoted, his period of belonging and his advancement (measured in days) are the same. If a child was on register less than the number of days in the term, the days should be reported and used in the estimate of possible conditions, for such a child had some chance of promotion and his chance was greater the longer he was on the register. It is one of the greatest weaknesses of the present methods of reporting concerning promotions that no account is taken of the children who dropped out during the term without having been advanced. Any number of these may take place, and the promotion rate will not be affected. I have known of instances where pupils not maintaining themselves were induced to leave school just before the end of the term, in order that the promotion rate might not be diminished by the fact of their being on register at the end of the term.

By the method I am proposing, the promotion rate would equal the aggregate days of register of all promoted pupils divided by the aggregate days of register of all pupils for the grade and period in question. Of course, all pupils transferred from one class to another within the same grade should carry to their new class their days of register in the class (or classes) to which they have previously belonged during the term. An illustration may be given of how this method would register conditions more truly than do the methods now in use. Suppose a class to have consisted of 40 pupils at the beginning of a term of 100 days. Suppose that one pupil dropped out after belonging 10 days; another after belonging 25 days; and a third after belonging 75 days; and that of the remaining 37 all were promoted during the term, no incidental promotions having been made. The register at the end of the term is 37; and the number of promotions is 37. By both the methods commonly used, the promotion rate would be 100 per cent. Observe, however, that this leaves wholly out of account the possibility involved in the three children who were dropped and not promoted. In some way, these should appear in the second term of the ratio. The extent to which they should appear is precisely indicated by the number of days each one of them belonged to the school. The first term of the ratio would be 3,700, the aggregate days of register of the promoted pupils; the second term of the ratio would be 3,700 + 10 + 25 + 75, or 3,810; and the promotion rate would be 97 per cent. I maintain that this is a truer expression of the condition than the 100 per cent rate that the methods now in use would yield.

The fact is worth noting that this method automatically takes care of the puzzling question of what the unit should be in reporting promotions, i.e. whether the unit is the child promoted or the fact of advancement. If a child is advanced two grades either at the same time or successively, does this count as one or as two, in reporting promotions? By the method indicated here, it would count as two, and each successive advancement would show in the report of the grade from which the advancement took place. When a child is promoted two grades at the same time it will be better to regard the child, for record purposes, as for a time (say, one day) in the grade over which he skips. As a matter of fact, double promotions seldom take place, and when they do take place, it is almost always at the close of a term. Under such circumstances, a child has probably been prepared for the double advancement by being instructed in the work of the grade he is about to skip. The time devoted to this advanced instruction may very properly be reported as time in the grade to be skipped.

The usefulness of promotion rates as indices of efficiency may be illustrated from material which came to my hand while I was at New York. I obtained promotion rates of the 478 school organizations for the year 1914-15, and related them to the sizes of schools, as well as to the attendance rates and the rates of overageness. The next chart presents, graphically, the general relation which exists between size of school and promotion rate.* It is evident that large schools are quite as likely to have high promotion rates as are small schools. The average rate of promotion for schools smaller than the average size was 86.8; while that of schools larger than the average size was 88.1.

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*Not shown in this report.

	56-58	59-61	62-64	65-67	68-70	71-73	74-76	77-79	80-82	83-85	86-88	89-91	92-94	95-97	98-100	
Under 200	1		1					2	1	8	7		4	2		26
201-400						1		2	2	6	2	4	1			18
401-600								1	2	5	8	7	1		1	25
601-800							1	1	5	5	5	11	4		1	33
801-1000									5	8	13	5	3	2		36
1001-1200								2	6	7	16	13	7			51
1201-1400									5	13	23	15	7	2		65
1401-1600									3	8	8	13	6	1		39
1601-1800									2	6	9	10	1	1		29
1801-2000									3	8	11	7	7	2		38
2001-2200									2	5	11	10	5	1		34
2201-2400									2	3	5	9	1		2	22
2401-2600										3	4	4	2	1		14
2601-2800									1	3	3	5	3	2		17
2801-3000										2	2	3	1			8
3001-3200											3	2	3			8
3201-3400								2	1		3	1	1			8
3401-3600								1		1						2
3601-3800											1					1
3801-4000													1			1
4001-4200												2				2
4201-4400																
4401-4600												1				1
	1		1			1	1	11	40	91	134	122	58	14	4	478

FIG. IV. CORRELATION OF PROMOTION RATE WITH SIZE OF SCHOOL. (Horizontal scale is for promotion rates; vertical scale is for registers of schools.)

This chart (Figure IV) is a correlation table for promotion rate and size of school. From it, the Pearson coefficient turns out to be +0.17, with a probable error of 0.03. Whatever relationship, therefore, exists between size of school and promotion rate is a direct one, altho it is too small to be of much consequence.

	56-58	59-61	62-64	65-67	68-70	71-73	74-76	77-79	80-82	83-85	86-88	89-91	92-94	95-97	98-100	
80																
81						1										1
82									1	1						2
83								1		1	2					4
84									1	1	1					3
85								1		2		4	1			8
86										3	4	2				9
87									3	1	3	1	1			9
88									5	13	9	10	4	1		42
89	1							2	3	10	16	15	8	2		57
90								1	6	21	39	19	16	2		104
91			1					4	9	17	25	36	17	4	1	114
92							1	2	7	7	22	15	5	2	1	62
93									3	8	7	13	3	2	2	38
94									1	3	4	6	2	1		17
95									1	1			1			3
96										2	2	1				5
	1		1			1	1	11	40	91	134	122	58	14	4	478

FIG. V. CORRELATION OF ATTENDANCE WITH PROMOTION. (Horizontal scale is for promotion rates; vertical scale is for attendance rates.)

An interesting question as to the relation between attendance and promotion arises. A correlation table for these facts is shown on the annexed chart (Figure V); and from it the Pearson coefficient is found to be +0.15; the P.E. is 0.03. Thus it is shown that there is a slight tendency for schools having high rates of attendance to have high rates of promotion also. It may seem surprising that the tendency is not stronger. In fact, I think that most persons would have supposed that the correlation would be much higher than is indicated. As indices of efficiency, however, there is here a relative independence which shows the caution which should be observed in drawing inferences as to the efficiency of organization in a school system from a single feature.

Since the number of children in attendance, in relation to the register of a school, implies little as to the proportion of children promoted, it is obviously necessary to obtain both rates. This shows quite clearly that no single statement may be taken as sufficient indication of desirable organization. The average rate of attendance in the New York schools was, for the year 1914-15, 90.3 per cent. This must be taken, therefore, as indicating nothing more than it pretends to indicate, namely, a certain amount of efficiency in securing the presence of children at school. It implies little or nothing in regard to anything else. It must be taken by itself. The rate of promotion for the New York schools, for the same year, was 88.5 per cent. This figure, likewise, must be taken as indicating nothing more than the extent to which children were advanced in the grades. It is so easy to draw from statistics inferences which are not warranted that this caution is worth emphasizing. In this case, as in so many others, figures must be taken for what they mean, without implications as to anything else, unless the implications themselves have been established.

On the other hand, it must not be assumed that there is any opposition between desirable attendance rates and desirable promotion rates. It is true that the correlation is low, being, as I have said, only +0.15, but the probable error is likewise low, being only 0.03. The coefficient, therefore, is five times the probable error, which is more than enough to establish the existence of relationship. The points to be borne in mind are: First, that favorable attendance conditions do not necessarily imply favorable promotion conditions. Each index is itself independently necessary in the estimate of school organization. Second, there is, on the other hand, no opposition between these characteristics; but there is an unmistakable tendency, discoverable among a large number of schools, for these favorable conditions to be found together.

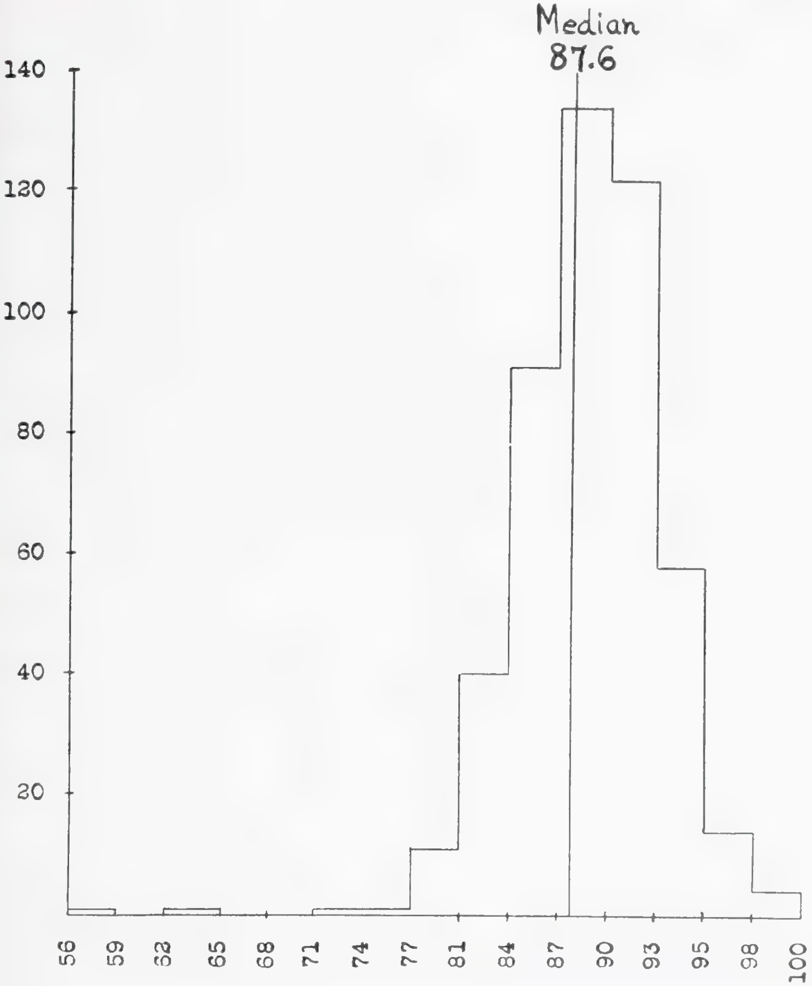

FIG. VI. FREQUENCY OF PROMOTION RATES.

The annexed chart (Figure VI) shows the distribution of schools at New York, according to their rates of promotion. Observe that, with the exception of two schools whose promotion rates were very low, the surface is substantially that of a normal frequency surface of small variability. Observe that the median school has a rate of 87.6 per cent, altho the promotion rate for the city, taken as a whole, was, as I have said, 88.5 per cent.

An examination of the promotion rates as reported for cities in the United States of over 300,000 inhabitants shows that 10 of these cities report promotion rates based on the number of end-term promotions divided by the end-term register. The rates for these cities range from 80.8 per cent for Philadelphia to 93.6 for Seattle. The median condition is represented by New York, at 88.5 per cent, and Boston, at 87.4 per cent. Probably it is a safe statement to make that the promotion rates by the end-term method, for the largest cities of the country, is about 88 per cent. The rate, in general, has been rising steadily ever since it has become a matter of reporting, as is usually the case. About ten years ago the rate was not much, if any, more than 80 per cent. The city superintendents of but four of the cities of this class report promotions based on the register plus incidental promotions. These four cities are Milwaukee, 89.5 per cent; New York, 88.8 per cent; Philadelphia, 85.8 per cent; and Newark, 83.0 per cent. The rate, in general, by this method, is probably about 88.5 per cent.

Passing now to the consideration of the ages of pupils with respect to grade, it may be stated at the outset that this feature of city school reporting is the most recent of those which we have been considering. It was in 1904, that City Superintendent Maxwell of New York made the first systematic beginning of this kind of reporting. At the end of the school year 1903-04, there were registered in the elementary schools of that city 491,674 pupils, and the number of overage pupils was shown to be 192,143, or 39.0 per cent of the registration. The reports of no other city offer so long a period of years over which comparisons may be made with respect to overageness. Beginning in 1904 with 39.0 per cent, the rate of overageness, computed by the method then used, has steadily diminished, until it reached 19.1 per cent in 1915. This means that whereas in 1904 practically 2 children out of 5 were too old for their grades, in 1915 but 1 child in 5 was too old for his grade. In other words, in the period of 11 years, the per cent of overage children has been cut in half. This is, of course, on the assumption that the method of reporting used in 1904 is unchanged. The method used at that time was as follows: The ages of children were taken on June 30 the last day of the school year—after the pupils had been promoted to their new grades. In the first grade, children were called "overage" if they were over 8 years of age; in the second grade if over 9; in the third grade if over 10, etc.

The method in New York, however, has twice been changed, and each time in the direction of adopting a more severe standard.

The last change was introduced in the school year 1914-15, and whereas the rate on the original basis was, as stated, 19.1 per cent, the rate on the new basis for the same pupils was 34.6 per cent. This serves to indicate how important it is to define the method of handling the overage question.

Before passing to a description of the present method in use in New York, it may be well to point out that, as in the case of promotion rates, so in the case of the rate of overageness, a marked improvement of conditions follows as soon as the matter becomes one of systematic reporting. No one will suppose that if the attention of principals and superintendents had not thus been called to this matter, the rate of overageness would have been decreased by half in eleven years. I can state positively, of my own experience, that no official pressure was brought to bear upon principals of schools to decrease the amount of overageness, other than the publication of the rates. For the first nine years of the period, the rates were published only for the city and for each of the five boroughs of the city. For the past two years, they have been given for individual schools.

I shall now describe, in some detail, the method which I have used for gathering statistics in regard to the ages of children. A few guiding principles may be stated, as follows:

1. It is desirable to receive the information directly from its source.

2. All tabulations should be made at the central office, under the direction of a person trained for this kind of work.

3. The record of the ages of children should be taken at the time when the problem of adjustment arises and when remedial measures may, therefore, be taken.

4. The standard should be such that children are regarded as overage if they are not in the way of being graduated by the time they reach the age of fifteen.

5. The central office should promptly report to principals and teachers the rates for their schools and classes, and should make available to them all the supporting data.

These principles are, for the sake of clearness, stated in somewhat dogmatic form. The principle of receiving the material directly from its source means that the record of the ages should be taken by the teacher, from the register, as the primary source of the material, and the record should be received at the central office, as made by the teacher. The report for the school will, therefore, consist of as many reports as there are teachers in the school.*

The advantage of receiving the information as made out by the teachers is obvious. Richness of detail is afforded which could not be obtained if the reports were tabulated by the principal for the school and forwarded as a school report. Error in tabulation at the schools is avoided; and in large systems where tabulations would be carried out in many different schools, the amount of this error would be considerable.

The problem of adjustment referred to in the third principle takes place at the time of the reorganization, due to promotion, at the beginning of the term or year. It is at that time that the ages of pupils should be taken. A copy of the class report should be retained by each teacher, for her information. Indeed, most teachers will indicate in their roll-books the fact that a child is overage. Thus this system of reporting not only brings the problem to the attention of teachers at the time classes are organized, but it also enables each teacher to make the precise application of the problem to individual pupils.

The standard set in the fourth principle is called the "up-to-fifteen" standard. Of course, an up-to-fourteen-and-a-half standard, or an up-to-fourteen standard may be used. None of the larger cities in the country are using a standard more rigorous than the "up-to-fifteen" standard. The justification for it lies in the fact that compulsory education laws generally require the attendance of children up to the age of fourteen, and if a child has reached the eighth grade not later than his fourteenth birthday, there is strong likelihood of his remaining until graduation. It is a fact, also, that the elementary school curriculum is devised upon the assumption that children will begin school at 6 years of age and be graduated when they are 14, i.e. before their fifteenth birthday.

The plan which I am suggesting will, therefore, require a report from each teacher at the beginning of each term (or year, if promotion takes place yearly).

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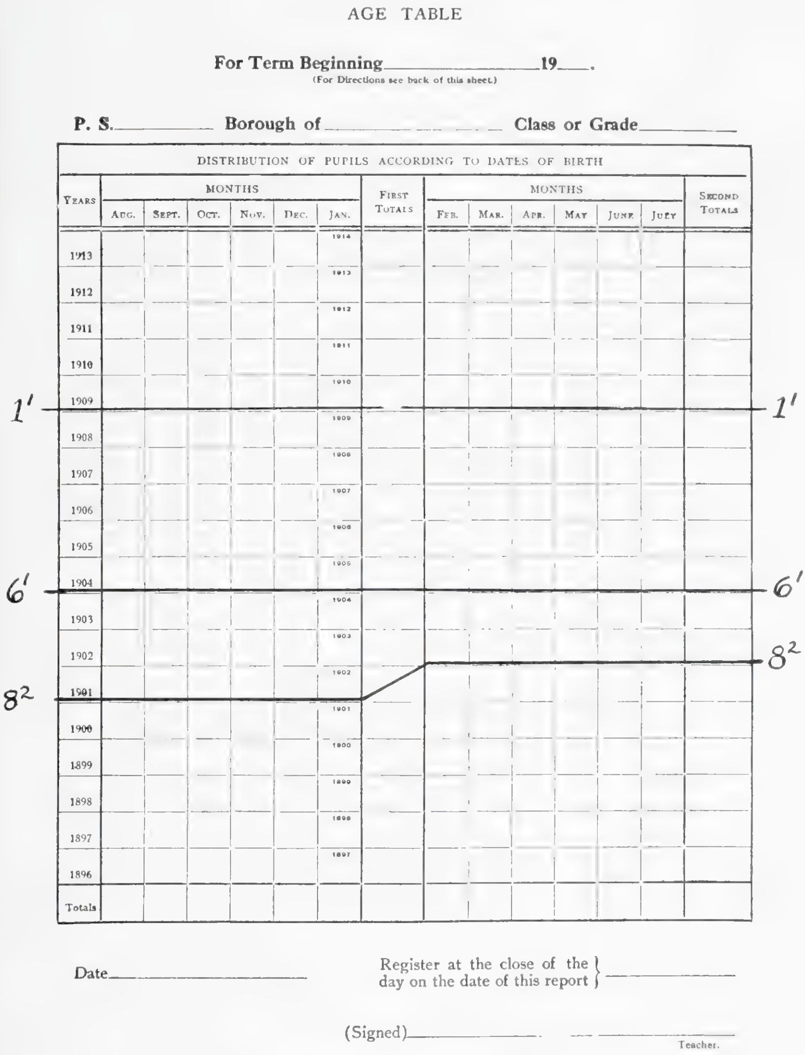
*If more than one grade is taught by a given teacher, the teacher should render a report for each grade in her charge.



AGE TABLE

For Term Beginning______________19___.
(For Directions see back of this sheet)

P. S._________ Borough of ______________ Class or Grade_________

DISTRIBUTION OF PUPILS ACCORDING TO DATES OF BIRTH

Years	Months						First Totals	Months						Second Totals
	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.		Feb.	Mar.	Apr.	May	June	July	
1913						1914								
1912						1913								
1911						1912								
1910						1911								
1909						1910								
1908						1909								
1907						1908								
1906						1907								
1905						1906								
1904						1905								
1903						1904								
1902						1903								
1901						1902								
1900						1901								
1899						1900								
1898						1899								
1897						1898								
1896						1897								
Totals														

Date____________________ Register at the close of the day on the date of this report } ______________

(Signed)______________________________
Teacher.

FIG. VII. AGE TABLE.

This chart (Figure VII) shows the form of report which is being required from the New York City teachers. It represents an evolution, and is itself likely to be changed. The principle, however, is clear. The teachers are not called upon to record the ages of the children, but, rather, their dates of birth. This is a detail which is worth considering. It was adopted because teachers' roll-books showed dates of birth, instead of ages. I found that a form of report calling for the ages of pupils introduced a great deal of error, due to the fact that teachers cannot, with anything approaching uniform accuracy, subtract the date of birth of a child from a given date at the end of the term. Accordingly, all that is required on the blank shown in this chart (Figure VII) is that a teacher enter a score-mark for each pupil opposite the year and under the month of his birth, the days of the month being neglected. After entering the score-marks for the dates of birth of pupils these are counted and entered in the columns headed "First Totals" and "Second Totals". For the purpose of checking the work, vertical totals are also entered, and the footings of the first totals and second totals taken together should equal the register at the close of the day on the date of the report.

You will notice that first and second totals are called for. The reason for this is that by so doing the number of pupils born within each of the two six-months' periods corresponding to the half-years of school may be shown for any year. Since the calendar year does not correspond to the school year, the matter of gathering the numbers of children born in the different months is not as simple as it might at first appear, unless we are willing to re-group the children at the central office and to lose the natural grouping which this table affords. Permit me to show you what I mean by the "natural grouping". Suppose this blank to have been made out for the second half of the present school year, and suppose, further, that it has been made out by a teacher of the first half of the first grade. Altho the report will have been made out at the beginning of the term, which, in New York, would be February first, the ages, as I have just stated, are to be computed to the end of the school year, i.e. to July 31. Therefore, what we wish to know is the number of pupils who will be over 7½ years of age by July 31, 1916. All such pupils are overage in the first half of the first grade. Pupils will be 7½ years of age, or older, on July 31, 1916, if they were born on or before January 31, 1909. If a teacher of a class in the lower first grade, after scoring the ages of her pupils on this blank, draws a line straight across here (indicating the line between 1908 and 1909), all the pupils whose ages are scored below the line will be overage, and all those scored above the line will be at age or younger. If she draws a line here (indicating the line between 1909 and 1910), she will inclose all the children in her class who are of normal age, adopting 6½ to 7½ as being normal. In the same way, a teacher of any grade may, after scoring the ages of the pupils, mark off those who are overage, those who are normal, and those who are underage. In the form as used at New York, information is given on the back to show how this may be done.

There is an added advantage in having the dates of birth rather than the ages of children made the basis of the reporting. When ages are to be reported and the teacher works from dates of birth, she has to make thirty or forty subtractions in filling out the report. When the dates of birth are directly reported, all children who were born, say, in August, 1908, of whom there may be hundreds or thousands, are recorded as to their ages, by a single subtraction, thereby enormously reducing the amount of labor involved. The principle of calculating ages to the end of the term stresses the problem to be met, namely, the completion of the elementary school course before the fifteenth birthday, or the completion of any grade of work before the age corresponding to the grade. We therefore desire to secure the ages of pupils at the end of the term or year while taking the count at the beginning of it. This is not usually done, but it presents no difficulty, and it has at least one advantage which has not been mentioned. It automatically takes account of pupils who drop out during the term.

It has been a matter of criticism, in City Superintendent Maxwell's reporting on age conditions, that he did not show the ages of the "thousands of children" who were dropped from the register during the year. By taking the count at the beginning of the term, all such pupils are recorded. This method was followed last year. The result, however, indicated that there was no bias to be inferred from the fact that in former years pupils who left school had been omitted from the count. It will readily occur to you that by taking the count at the beginning of the term we are out of the frying-pan and into the fire, because, while including those who drop out, we exclude those who are admitted subsequent to the beginning of the term or year. With a view to testing the extent to which the reporting of new admissions was worth while, I provided, last year, that the teachers should retain a copy of the report forwarded to the city superintendent at the beginning of the term, and that for all new admissions after the report was made out, the ages should be scored in red. At the end of the term, a copy of the teacher's retained blank, with the original and red scorings, was forwarded to the city superintendent's office. This is a detail which can easily be provided, if anyone cares to do so. I did not find last year that the method of reporting the ages of new admissions yielded significant data. There is apparently no material difference between the age groupings of the admitted pupils and of the pupils on register at the beginning of the term.

Permit me to dwell for a moment upon an advantage which follows from this method of gathering information in regard to the ages of children in respect to grade. I have suggested that by getting the reports directly from the teachers, a richness of detail is possible which is lost when the reports are summarized at the schools. No system of reporting with which I am familiar divides the ages of children into any finer steps than half-years. This blank permits the tabulation of the ages of children by years and months. Probably in most cases it will not be found advisable to tabulate—much less to print—the ages of children as accurately as this, but, for many purposes—particularly for the principal at the school and the class teacher—it is exceedingly important to know just how much the children are above normal age. It is always found, when age-grade statistics are reported, that the largest group among the overage children is the group next older than the upper limit of normal age. For instance, if in the last half of the sixth grade the normal age is 13 years, and ages are being reported on the half-yearly basis, it will be found that the largest half-yearly group of children older than 13 is the group whose ages are between 13 and 13½. Similarly, when the ages of children are found in years and months, a very large group of children—often the largest—will be found to be one month, or less, above normal age. The treatment of these children will doubtless be different from that of children who are much older than the normal age. The majority of them can probably be advanced an extra grade, by special effort, without lowering the standard for promotion. They would thus become of normal age for their new grade. The thought which I wish to bring out is that frequencies within the group "Overage Children" are greatest near the normal group, and that these are exactly the children who will probably most readily respond to special treatment.

The efficiency index which I propose in this connection I shall call the "age rate". It is the ratio of the number of normal and younger children to the register at the time of taking the count. You will see that it is again an application of our principle of expressing the ratio of actual to possible conditions. It is more usual to express the compliment of this rate, namely, the rate of overageness. I have chosen to use the rate of normal or younger children, because the rates then present the same form as do those of attendance and promotion, where, in all cases, 100 per cent means perfection.

We shall now inquire into the relation between the age-grade rate and some of the other factors which we are considering.

	36-38	39-41	42-44	45-47	48-50	51-53	54-56	57-59	60-62	63-65	66-68	69-71	72-74	75-77	78-80	81-83	84-86	87-89	90-92	93-95	96-98	
Under 200	1			1		2			3	2	3	2	3	6		1	1	1				26
201-400	1					1	2	2	4	1	3		1	1			1					17
401-600					1	1		1	1	3	6	1	8	1	1	1						25
601-800				2		1	2	4	2	4	7	3	3	1	3	1						33
801-1000						2	3	3	8	7	3	3	4	1			2					36
1001-1200				1	1	4	2	6	7	9	7	4	6	1	1	1						50
1201-1400				1		1	9	8	13	8	8	5	3	4	3	1					1	65
1401-1600					2	2	2	3	5	3	7	6	5	2	1							38
1601-1800						2		4	4	3	10	2	2	2								29
1801-2000						2	3	4	4	3	10	5	5		1							37
2001-2200						2	2	3	2	6	8	6	3	1		1						34
2201-2400							2	1	2	5	2	6	1	1	1		1					22
2401-2600				2		1		1	1	2	2	3	1	1								14
2601-2800						1		4	2	1	3	2	3				1					17
2801-3000						1		1	2	2			1		1							8
3001-3200								2			3	2	1									8
3201-3400									1	2	2	2	1									8
3401-3600									1	1												2
3601-3800													1									1
3801-4000														1								1
4001-4200														2								2
4201-4400																						
4401-4600													1									1
	2			7	4	23	27	47	62	62	84	52	53	25	12	6	6	1			1	474

FIG. VIII. CORRELATION OF AGE RATE WITH SIZE OF SCHOOL. (Horizontal scale is for age rates; vertical scale is for registers of schools.)

This chart (Figure VIII) is a correlation table, the horizontal scale of which represents age rates, and the vertical scale of which represents sizes of schools. You can see from the position of the figures that there is little, if any, of that trend from upper left to lower right, which would imply a direct correlation. As a matter of fact, the correlation is +0.03, with a probable error of

0.03. The coefficient, therefore, is not only very low, but it is no larger than its probable error. In this instance, even more than in the case of attendance and promotion, the fact that a school is large, or medium, or small has no bearing.

	36-38	39-41	42-44	45-47	48 50	51 53	54-56	57-59	60-62	63-65	66-68	69-71	72-74	75-77	78-80	81-83	84-86	87-89	90 92	93-95	96-98	
80																						
81													1									1
82											1		1									2
83						1				1				2								4
84											1		1	1								3
85						1		1			2		1			1	2					8
86							3		1	2	2	1										9
87						1	2		1		2	1	1	1								9
88				1		5		6	8	1	7	2	5	5	1							41
89				1		2	3	4	4	9	9	7	7	5	3	1	1	1				57
90				2		2	4	13	11	13	22	15	16	1	4		1					104
91	1				1	2	5	7	20	20	23	9	12	7	3	1	1				1	113
92	1				1	6	2	7	5	10	9	11	4	1		2	1					60
93				1	1		3	6	8	5	5	3	3	2		1						38
94						2	4	1	4	1		3	1		1							17
95				1	1			1														3
96				1		1	1	1			1											5
	2			7	4	23	27	47	62	62	84	52	53	25	12	6	6	1			1	474

FIG. IX. CORRELATION OF AGE RATE WITH ATTENDANCE RATE. (Horizontal scale is for age rates; vertical scale is for attendance rates.)

The next chart (Figure IX) shows the relation between age rates and attendance rates in the 474 elementary school organizations at New York City for which age and attendance figures were available. You will observe that not only is the trend from upper left to lower right absent from the diagram, but that there even appears to be a trend from the upper right to the lower left, indicating an inverse correlation. As a matter of fact, the Pearson coefficient is -0.17, with a probable error of 0.03. This inverse correlation may be surprising. It is true that it is not large; altho when taken in relation to the small probable error, it cannot be neglected. It is never safe to argue about causation from coefficients of correlation. It would be absurd to suppose that a high attendance rate caused overageness, or that a large amount of overageness was a cause of high attendance rates. However, that high attendance rates and low age-grade rates may exist together in the same schools is abundantly shown by this table. It is probable that all that it means is that older pupils attend school more regularly than do younger pupils.

	36-38	39-41	42-44	45-47	48-50	51-53	54-56	57-59	60-62	63-65	66-68	69-71	72-74	75-77	78-80	81-83	84-86	87-89	90-92	93-95	96-98	
56-58										1												1
59-61																						
62-64	1																					1
65-67																						
68-70																						
71-73													1									1
74-76										1												1
77-79						3	1	1	2	1	1	1		1								11
80-82					1	3	5	6	9	6	4	2	1	1	2							40
83-85				2		10	10	13	16	10	9	11	4	2	1	1	1					90
86-88	1			3	1	6	7	16	12	22	25	15	14	6	3		1				1	133
89-91				1			1	7	20	13	28	16	19	7	4	3	2					121
92-94					2	1	2	4	3	7	14	6	12	4	1	2						58
95-97							1			1	2	1	2	3	1		1	1				13
98-100				1							1			1			1					4
	2			7	4	23	27	47	62	62	84	52	53	25	12	6	6	1				474

FIG. X. CORRELATION OF AGE RATE WITH PROMOTION RATE. (Horizontal scale is for age rates; vertical scale is for promotion rates.)

This chart (Figure X) shows the relation between age rates and promotion rates for 474 schools in New York last year. There is here a positive correlation of 0.22, with a probable error of 0.03. This direct relationship, altho the r-value is not large, is significant when taken in connection with the fact that it is more than seven times its probable error. It is doubtless true that, in general, schools having high promotion rates show, likewise, good conditions in respect to the ages of pupils.

This chart (Figure XI) shows the distribution of 474 schools according to the per cent of children at age or younger. Two schools have very low rates, and one school has an abnormally high rate. The rest of the schools distribute themselves in an approximately normal way about the median, which is at 66.7.

In all three of these indices—attendance, promotion, and age rates—there is no such close relationship between any two of them that one may be inferred from another. It is evident that there is no indirect measurement of age conditions when promotion rates are known. Likewise, there is no indirect measure of promotion to be derived from attendance. If we wish to know the status of a school with respect to any of these facts, we shall have to express each of them independently. That is why they are valuable indices of efficiency worthy to be considered and reported separately.

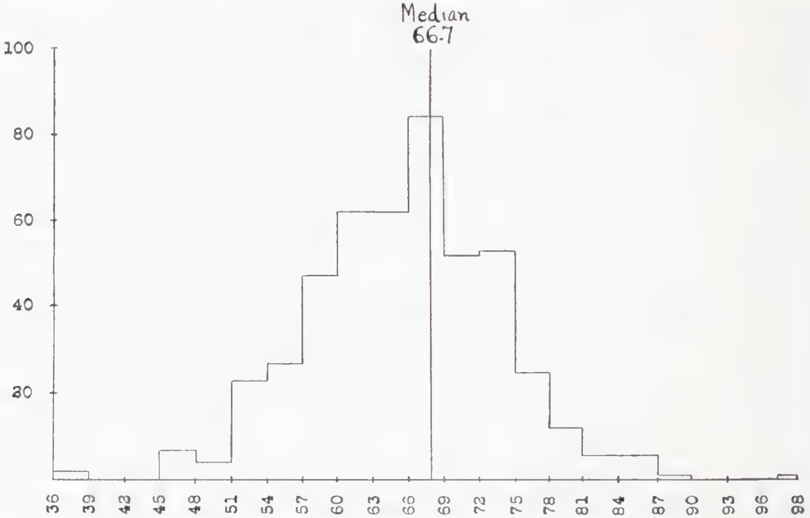


FIG. XI. FREQUENCY OF AGE RATES.

I have suggested, in the beginning, the consideration, likewise, of economy both in respect to organization and to cost. Both these matters deserve much fuller treatment than I can give them here. An index of the economy of organization may be found in the average size of class, or ratio of the number of pupils to the number of teachers employed. Last year considerable work was done on this problem at New York, and no work was used more effectively in promoting closeness of organization. Three times a year an analysis was made of the number of classes of different sizes, and of the number of pupils enrolled in these classes. By this means the department was able to check up the number of unduly large classes and to divide them, and it was also able to check up the number of unduly small classes and to combine them. I do not feel that I ought to take your time in entering into this phase of the question of economy. I should, however, like to ask your attention to one matter which I consider especially important.

As an index of economy, the cost of instruction per pupil per hour may be used. This was computed last year at New York by a method which I shall take a few minutes to explain The cost of instruction is taken to include (1) the cost of teachers' salaries, and (2) the cost of educational supplies, including testbooks, stationery, and all supplies necessary for the instruction of children. In other words, I am excluding the items of school expenditure which do not vary closely with the number of pupils receiving instruction. I obtained from each school, as a matter of regular reporting, the aggregate daily register of each class. This aggregate register was multiplied by the number of hours of instruction per day which the class received. These aggregates were combined, for schools and for the entire city, thus furnishing the aggregate number of hours of instruction which the elementary schools of the city gave to pupils during the school year. This aggregate reached the enormous total of 617,767,110. Observe that altho I call these the aggregate hours of instruction, they are really the aggregate hours of register. In other words, I am using the register rather than the attendance as the basis for computing cost.

A few words may not be amiss as to the propriety of using the register rather than the attendance of pupils as the basis for computing the unit cost of instruction. In the first place, expenditures for teachers' salaries are adjusted to register rather than to attendance. The number of teachers required in any given school is determined on the basis of register rather than of attendance. Requests for increase and decrease of classes are supported by evidence as to the registers of classes. The creation of special classes and of classes for defective children is again based upon the number of children who will belong to the classes, rather than upon an attempt to determine those who will actually attend them. Of course, the number of attendants is considered to be a rough approximation of the number belonging, but, so far as the two numbers differ, it is the latter rather than the former which determines the need for the class.

In the second place, expenditures for textbooks and supplies, wherever these are furnished by the board of education, are based upon register. Allotments of money for the ensuing year, are made to principals of schools, on the basis of the number of children belonging to the school, i.e. upon the register, and not upon the attendance. If a principal makes application for an additional appropriation, the supporting data are again those of register; he shows an increase in the number of children who belong to his school, over the number upon which the original appropriation was based.

It has been argued that the estimate of instruction, when based upon attendance, constitutes "solid service". The argument respecting "solid service" is a fallacy drawn, in all probability, from the industries, where, in a different sense, it plays an important part. The analogy, however, does not apply to the schools. The attendance or absence of employees in a factory is indeed determinative of output, and the cost per operative must surely leave out of account the operatives who are absent. This might, indeed, furnish an analogy for application to teachers, but it can form no proper combination as applied to pupils. They are not employees, nor do considerations applicable to employees apply to them. If we must use factory terms in our educational vocabulary, we may say that the pupils represent the raw material, and that the product is the refinement of this material. And the peculiarity about the raw material is that whether it is physically present or absent, it is always present in the sense that it always belongs to the work of the school, and that it is always to be refined.

The service which is based upon attendance is indeed "solid", but it is only a fraction of the total instructional service rendered. Far the greater part of the aggregate absence of pupils is an accumulation of many short periods of absence, due to temporary causes. There is in most cities, and there ought to be in all of them, provision for the discharge from the register of pupils who are required, for proper reasons, to be absent for longer than a prescribed period. Pupils who are absent for insufficient reasons are being reached more and more effectively every year, thru the compulsory education service. What justification, therefore, that there might have been in the past for basing instruction upon attendance—a justification due to the fact that the register was a variable quantity—appears to be becoming of less force as the school business becomes more definitely organized and school laws become more adequately enforced.

The estimate of the amount of instruction, as based upon attendance, has, I believe, been foisted upon the educational world by business men who failed to make the proper distinction between cost accounting in business and cost accounting in education. No school man would conduct an educational system on any other basis than that the teachers are responsible for the instruction of all pupils belonging to their classes. Promotion rates are based upon the ratio of pupils advanced to pupils on register. The number in attendance is disregarded. The instruction is for all, and the service is rendered to all. Textbooks and supplies—an important element in cost of instruction—are likewise issued, in general, to all pupils who are registered. Each child has his own textbooks and material. If he is absent, he either has his books at home, or they are left at the school. In either case, it is not practicable to issue them to another pupil. The loss, damage, and waste incident to a divided responsibility for them could not be justified.

Finally, the service based upon attendance is not "solid" even in the sense in which those who use it appear to think it is. The reporting of attendance is, in all localities with which I am familiar, based upon the assumption that a child present part of the day is to be reported as in attendance for that day. Thus the basing of cost upon attendance admits a margin of error, due to the fact that thousands of children every day attend school only a portion of the time devoted to instruction for their classes. A great many attend in the morning who are absent in the afternoon. Others are present in the afternoon and not present in the morning. Still others are excused during either the morning or the afternoon session. The minute we try to base cost upon attendance, we are confronted by such perplexing problems as these. For legal purposes, fractions of days may be counted as whole days; but if we are to estimate the amount of "solid service" as based upon attendance, we shall be obliged to introduce refinements of reporting attendance which would be burdensome and intricate. There can, however, be no doubt as to the length of time during which it is proper to say that a child belongs to the school, that is, there can be no doubt as to the number of days that he is on the register.

I cannot give you the cost of instruction per pupil hour on this basis for any other city than New York. The following facts, however, were true for that city for the school year 1914-15: For elementary schools, exclusive of kindergartens, the aggregate hours of register were, in round numbers, 618,000,000; the cost of the salaries of principals and teachers was \$23,500,000; and the cost of supplies \$1,390,000, giving a total cost of instruction, defined as above, of a trifle less than \$25,000,000. On these bases, the cost of salaries for each hour a pupil was registered was \$.038; the cost of educational supplies was \$.002¼; making the instructional cost almost exactly \$.04. For kindergartens, the aggregate hours of register were more than 18,000,000, and the cost of instruction (salaries and supplies) was a little less than \$1,000,000. Accordingly, the cost of instruction was \$.053 per pupil per hour for kindergartens. For elementary schools, including kindergartens, the cost of salaries was \$.0383; the cost of supplies was \$.002¼; and the cost of instruction \$.0405.

The cost of instruction per pupil per hour, in elementary schools at New York, has also been computed on the basis of attendance. It is interesting to note the difference between this cost and similar cost on the basis of register. In the Annual Financial and Statistical Report of the Bureau of Audit and Accounts for the New York Department of Education, the cost per pupil per hour is given for 1914, on the basis of attendance, as \$.04564. That is to say, the cost on register is almost exactly 4 cents an hour for each pupil, while that on attendance is more than 4½ cents. This difference of ½ a cent per pupil hour, it is maintained, represents a true statement of the cost of extension of educational service to pupils belonging to the schools during such time as they are not in attendance. It is precisely our contention that the service is, in fact, extended to such pupils, and that, accordingly, the cost of instruction for each pupil during every hour that he is a member of a school is properly the figure to be used and reported.

A Survey of the Gary Schools and the Pre-Vocational Schools in New York City

B. R. Buckingham

During the school year 1914-15 Superintendent Wirt of Gary, Ind., was retained by the Board of Estimate of New York City, and he organized during that year two schools on the Work-Study-and-Play plan. During the same year, there were organized by Associate Superintendent Ettinger of New York City six schools with a pre-vocational course of study. This course of study affected only the seventh and eighth grades.

City Superintendent Maxwell asked me to make a study of these two types of experimental schools with a view of ascertaining the success which they had in the instruction of their students in some of the regular academic subjects. It was his thought, and it is also mine, that no matter how people may differ as to their educational creeds, no matter how they may vary in their conception of how the elementary schools should be organized, no matter how wide a variation there may be in courses of study, there are, nevertheless, some subjects so fundamental, and there are some parts of these subjects so fundamental that ignorance of them is a misfortune, and instruction in them is an imperative necessity. The State, in extending universal education to the children of its citizens contemplates that they shall be informed concerning some fundamental matters, and whether the organization of the school be called by one name or another, we cannot regard an organization as successful unless it offers sufficient instruction in these fundamentals.

The report which I gave you yesterday was a by-product of this survey of the experimental schools in the City of New York. As you will remember, the subjects in which the children were tested were arithmetic, spelling, geography, history, and English grammar—all applied to the seventh and eighth grades. I may state general conclusions at the outset. The regular schools showed the greatest amount of improvement. The pre-vocational schools were next, and the Gary schools were last. This is a statement drawn from an enormous amount of detail.

It is only true as a general statement. There were many details in which the order of improvement was not as I have stated it.

These tests were designed to be tests of equal difficulty, and no small effort was expended to make them so. Question 1 of the March test, say in arithmetic, was, by a considerable amount of testing carried on thruout the country, determined to be of equal difficulty with question 1 of the June test; and question 2 of the March test was likewise a parallel question in point of difficulty with question 2 of the June test; and so on for the entire series. Since the elements composing the test were each equal in point of difficulty to a corresponding element in the second test, the tests themselves as total instruments of measurement might be said to be of equal difficulty. The actual questions are the ones I distributed to you yesterday morning.

First, the improvement in arithmetic, as measured by the per cent of pupils who did better in June than they did in March, was as follows: For the Gary schools, 40.7 per cent; for the pre-vocational schools, 47.6 per cent; and for the regular schools, 54.3 per cent. The rank of the different types of schools, therefore, was: regular schools first, pre-vocational schools second, and Gary schools third.

Second, in spelling the proportion of children who did better in the June test than in the March test was as follows: In the Gary schools, 52.8 per cent; in the pre-vocational schools, 63.7 per cent; and in the regular schools, 63.0 per cent. You will see, therefore, that the serial order was pre-vocational schools first, regular schools second, and Gary schools third,—a rather poor third.

Third, in geography, by the same system of parallel testing, the proportion of children who showed improvement in June was: For the Gary school, 58 per cent; for the pre-vocational schools, 53.4 per cent; and for the regular schools, 57.7 per cent. The serial order was: first the Gary schools, second the regular schools, and third the pre-vocational schools.

Fourth, in history the percentages of improvement were as follows: For the Gary schools 72.3, for the pre-vocational schools 67.2, and for the regular schools 63.2. The order, therefore, was: Gary schools first, pre-vocational schools second, and regular schools third.

Finally, in English grammar the improvement was: For the Gary schools 58.8 per cent of the pupils, for the pre-vocational schools 65.8 per cent, and for the regular schools 62.9 per cent. The serial order, therefore, was: Pre-vocational schools first, regular schools second, and Gary schools third. The Gary schools, on this basis of showing improvement, were third in arithmetic, third in spelling, first in geography, first in history, and third in English grammar. What I have just given you, bear in mind, is the proportion of children who showed improvement.

I have also estimated the improvement on the basis of the difference between the number of questions answered correctly in March and in June. If it is thought that the first basis for estimating improvement is objectionable, it will be thought so on the ground, in the main, that a child may show very large improvement and there will be no more credit indicated than there would be for a child whose improvement was very small that they are all counted, if they showed any improvement, simply as being so many children who improved. But for large numbers of children, those of you who are familiar with the behavior of figures drawn from abundant sources, will realize that, while this is a discrepancy which might come out for small groups of people, it would not when large groups were concerned; and this is borne out, in this study, by the fact that when improvement is shown on the basis of the difference between the number of questions answered correctly in March and in June, there is no change for any subject in the ranking of the three types of schools. On the second basis of improvement, if, in the Gary schools, on the average, 4½ questions had been answered correctly by each child in March, and if in the parallel test in June five questions, on the average, were answered correctly, then the improvement would be half a question. As I say, on this basis there is no difference in the character of the showing.

Thirdly, I showed the improvement on the basis of the relation between the actual and the possible improvement. In any given class, if one child is rated 40 per cent and another is rated 80 per cent, and if the improvement of each child is 10 per cent, making one of them 50 and the other 90, we are likely to feel that this is not to be interpreted as meaning that they both improved to the same extent. It is much harder for the child who is already 80 per cent to improve at all. The possibility of improvement is very much diminished.

Now, the child who was at 40 per cent and who added 10 per cent to his rating, would improve only one-sixth of his possible improvement, that is, one-sixth of the distance from 40 per cent to 100 per cent. His increase of 10 per cent would, therefore, mean 16⅔ per cent of his possible improvement. On the other hand, the child who began at 80 and advanced to 90 would improve 10 per cent where it was possible to improve 20 per cent. His increase, therefore, in relation to his possible increase would be one-half or 50 per cent.

I calculated the improvement for the different types of schools on this basis, and there was substantially no change except for the fact that the showing was somewhat more favorable to the regular schools, due to the fact that their ratings were, in general, higher to begin with. Accordingly, their improvement from the higher initial ratings counted more when one took it in relation to what their improvement could have been. The serial order for each of the subjects was only changed in the case of geography, where instead of the Gary schools being first by a small amount, the regular schools were first by a small amount.

When I sought an answer to the general question as to which type of school showed greatest, next greatest, and least improvement I first combined the scores for each of the subjects into one general score for all subjects taken together. The result was, as I said in the beginning, that the regular schools were first, the prevocational schools second, and the Gary schools third. By the first method (per cent of children who improved) the ranking was indicated by the figures 60, 59½, and 56. By the second method (difference between initial and final scores) the ranking was indicated by the figures 7.5, 7.3, and 5.6. By the third method (ratio of actual to possible improvement) the figures were 14.4, 13.3, and 9.7.

In the statements I have just made the assumption has been that one subject is equal to another. Now, we all know that this isn't true. No one would suppose that spelling was as important as arithmetic, not but that it may be socially as important—that isn't what I mean—but elementary schools don't spend as much time on it; it doesn't bulk as large in the total activity of the school as does arithmetic. Similarly, English grammar is of relatively less importance, on the basis of the time cost in the curriculum, than geography. Accordingly, I weighted these subjects, taking account of the time spent in the study of each of them in the elementary schools. This had the effect of giving considerably more advantage to the regular schools than was given to them when each subject was counted as of equal importance. This was due to the fact that the one subject of the five to which the greatest amount of school time is devoted, namely, arithmetic, is exactly the subject in which the regular schools showed the greatest amount of superiority over the other two types. But upon any showing, whether it is the per cent of children who improve, or the difference between the number of questions they answered correctly, or the ratio of the actual to the possible improvement, or whether it be with subjects counted as of equal weight, or with subjects counted as weighted by the time spent upon them—in all cases, when the matter is boiled down to a general statement, the order of improvement is invariably the same.

Now, the method that I have followed in this report has been vigorously attacked. I haven't answered any of the criticisms, and I have no present intention of doing so. If it should come to the point where persons competent to judge an inquiry of this kind and willing to assume a reasonably detached point of view questioned the workmanship or pointed out instances where the interpretation of the data was erroneous or misleading, I might have something to say. Meanwhile, however, you should realize that in order to make the report understood by those for whom it was intended, it was necessary for me to avoid being lost in the great detail out of which the general conclusions arose. Anyone who wants to make a case wants the details, and a person can make out almost any kind of a case he likes from the details if he confines himself, either exclusively or generally, to those details that help the cause he wants to advocate.

If he is a bungler he will confine himself to such details exclusively; if he is artful he will include enough details of the opposite kind to give himself the appearance of candor. I have seen some very curious statements drawn from my own report, statements that are quite erroneous; and as long as they are, I feel quite sure that I can leave to competent people a judgment between the critics and myself.

It is true that the Gary schools had not been long organized, and it would have been outrageous if I had given them one test and drawn any conclusions from it, but I gave them two, and I drew no inference whatever from the first test, but only from the difference which was shown as between the first and the second. Now if the Gary schools in process of reorganization were discriminated against in the first test, it would be supposed that their situation three months later would be very much improved. They would be like a person who, due to some physical illness of the moment, performs below form, and then at a later time on a similar test, say of strength or intellectual ability, shows a marked improvement. That is the situation in which it seems to me the newly organized schools were. The very fact that they were in a disadvantageous condition at the time of the first test would operate to give them an unusual opportunity to show improvement between that and the second test.

If it is objected that the Gary schools were not really Gary schools and that conclusions about them should not be used as conclusions about the Gary system, I shall reply that I have nowhere applied them to the Gary system. The conclusions are true and valid for the schools investigated. What application others may give them on the basis of the schools being typical will be for them to justify. The following citation from the report will indicate my own attitude:[*]

"In all fairness some caution should be exercised in drawing from the data of this report inferences unfavorable to the Gary schools. We may properly remind ourselves that their educational philosophy is not that of the traditional schools, and that it is truer and more vital than any philosophy which the traditional schools usually put into practice. We ought also to remember that we are comparing two types of schools as to matters which one of them emphasizes and which the other does not. . . . The modern social philospohy, the philosophy of John Dewey and his school, is too profoundly true to be belittled by any one. In so far as Superintendent Wirt is actuated by that philosophy he should be given profoundly respectful attention. It appears not only that he is so actuated, but that he is one of the few persons who have consciously and systematically attempted to work over his theories into practice. Opinions as to his success in this most difficult task of translating theory into practice will vary between the opinions of those who blindly accept and seek to transplant them, and the opinions of those who, with equal blindness, reject them entirely.

"Meanwhile, however, it is entirely proper to seek to appraise the work of the schools conducted on the Gary plan. Superintendent Wirt has never objected to this. In fact, he has welcomed every attempt to survey the schools at Gary and is now planning to coöperate with the General Education Board for a systematic investigation of them. To accuse any one, therefore, of lack of sympathy with the Gary plan because he seeks to evaluate it, is to accuse Superintendent Wirt himself.

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[*] *Seventeenth Annual Report of the City Superintendent of Schools*, 1914-15, p. 57.

"If, then, we wish to appraise the work of the Gary schools we must suspend judgment concerning them until the appraisal has been made. We must give them abundant opportunity to justify themselves, and we must give them an attentive, sympathetic hearing. We must be judges and not partisans; neither so radical that the lessons of the past mean nothing to us, nor so conservative that our faces are not turned toward the light. In maintaining the judicial attitude we should insist that the Gary plan be set up only so far as favorable experimental conditions require. The evidence afforded by this report is unfavorable to the defendant. It shows that claims made have not, in these particular schools, been substantiated. It makes clear that in matters regarded by the State as constituting essential parts of an elementary education, these schools have been unable to advance as many of their pupils within a given time as have the schools offering the regular course of study."

Cost of Instruction in Indiana High Schools, and Related Topics

Hubert G. Childs, Associate Professor of Secondary Education, Indiana University

Until recently very little has been done in the administration of American school systems but to follow the lines of tradition and opinion, and some still work on this basis, as attested by a questionnaire received recently from the superintendent of one of our large eastern school systems, who wished to ascertain the opinions of superintendents and college professors regarding their estimate of the value of certain school methods. In reply an expression of opinion was given with this addition: "Why do you ask the opinions of superintendents and professors who know no more about it than you do? You have 30,000 or 40,000 children in your schools. Why not select twenty or thirty teachers in the grades in question, divide them into two equivalent groups, and have each group try out one of the two methods for a year, collect and tabulate data, and determine your future method by the findings?"

The American public high school has developed so rapidly in the past quarter of a century and has taken such hold upon popular imagination that it has been possible for the superintendents to ask for almost anything in the way of financial assistance and get it. The great increase in attendance and teaching staff and the increasing cost and variety of studies and of equipment have well-nigh brought us to the limit of our resources. It has now reached a point where the superintendent or principal who wishes to develop a new and important addition to his high school activities must be able to effect economies in his present practice, and to do this he must have definite standards of organization as a basis for convincing argument. More and more the school administrator is becoming an educational and business expert. Fifteen years ago no superintendent knew what per cent of his pupils were accelerated, normal, or retarded, but five or six years of careful investigation of the problem has made this one of the standard items of school administration, and has had wide influence in establishing departmental work and in breaking down the lockstep in educational advancement, and incidentally in reducing the cost of repeaters. Ten years ago scarcely a superintendent could tell the cost per capita for instruction in the elementary or high school.

In 1912 Superintendent Spaulding, of Newton, Mass., did pioneer work in determining the cost of instruction in the different high school subjects in each of his three high schools, for the purpose of reorganizing his courses and administrative procedure. Two years ago one of my graduate students worked out a master's thesis on this problem in the high school at South Bend, and within a year two other valuable contributions have been published on this subject: "High School Costs", by Dr. J. F. Bobbitt, of Chicago University, in the "School Review" for October, 1915, and "Cost of Instruction in Kansas High Schools", by Professor W. S. Monroe of the State Normal School, Emporia, Kan.

The topic on which I am to report today was planned with the committee of research of the State High School Principals' Association at the time of our conference one year ago.

In November, 1915, notice was sent to the principal of every commissioned high school in Indiana that such a study was to be made and that all the school had to do if it wished to coöperate was to send for the blank forms, fill them in, and return them to my office. Thirty-four schools have returned the data indicated on this form.

PROGRAM OF TEACHER'S WORK

INDIANA UNIVERSITY
SCHOOL OF EDUCATION
BUREAU OF COOPERATIVE RESEARCH

"COST OF INSTRUCTION"

City........................ School Date
Teacher......................... Sex Annual Salary
Number of Weeks in School Year

No. of Period	Time of Period	MONDAY			TUESDAY			WEDNESDAY			THURSDAY			FRIDAY		
		Subject	Gr.	No. in Class	Subject	Gr.	No. in Class	Subject	Gr.	No. in Class	Subject	Gr.	No. in Class	Subject	Gr.	No. in Class
1																
2																
3																
4																
5																
6																
7																
8																
9																
10																

FIGURE 1. COST OF INSTRUCTION FORM.

Time of period indicated thus, 9:00-9:45. Grade indicated thus, 9B, 9A, etc.

Subject taught: Include here also assembly, study hall duty, or any regularly assigned duty within the school day. On reverse side indicate any special duties as conducting orchestra, coaching athletics, etc., giving hours, days of week, and number of weeks of such services. Where extra periods over the regular 5 are assigned, as in science, etc., please indicate these extras by a star.

While this investigation had for its purpose the study of costs of instruction in different high school subjects under comparable conditions, the complete report will show the following subordinate topics:

1. Average salaries of teachers.
2. Average size of classes.
3. Number of large and small classes by schools, groups, and departments.
4. Average number of teaching periods a week per teacher.
5. Average number of 60-minute teaching hours a week per teacher.
6. Number pupil hours per week per teacher.
7. Number and per cent of teachers teaching each number of subjects from one to four or more.
8. Number of pupil enrollments per teacher.
9. Per cent the study hall cost is of instructional cost.
10. The per cent the credits attempted in each department are of all credits attempted.

The data from the teacher schedules for each school were assembled under the following form and from these, similar items were taken to make up the various comparative tables of this report.

Name of high school. Date

Number of weeks in the school year Number of minutes per class period

ITEMS OF INFORMATION	Commercial.	Drawing and Art	English	History	Household Arts	Language	Manual Arts	Mathematics	Music	Physical Training	Science	Average	Assembly	Extra Class
1. Enrollment														
2. Number class periods a week														
3. Number pupil recitations a week														
4. Number of pupil hours a week														
5. Cost of instruction a week														
6. Cost per 100 pupil hours														
7. The same, including assembly cost														
8. Number credits attempted														
9. Cost per credit														
10. The same, including assembly cost														
11. Number of classes														
12. Average size of classes														
13. Number of teachers														
14. Average annual salary														
15. Average number class periods a week per teacher														
16. Average number class hours a week per teacher														
17. Average number pupil hours a week per teacher														
18. Per cent of credits by departments														

FIGURE II. SCHOOL TABULATION BLANK.

In passing to a more detailed description of cost factors, I wish to indicate in a preliminary way certain factors that have been taken into account in determining the time and salary to include in making up this report. In case of the salaries of superintendents or principals who teach part time, it seemed unreasonable to count the proper fractional salary against teaching account as this higher salary was paid for executive and not for teaching ability. For this report the next even $100 above that of the highest paid regular teacher in the school was taken as the salary for the superintendent or principal, and then the proportional part, as determined by his time of teaching, was charged against instruction. In estimating the teacher's weekly time, time regularly given to assembly and study hall duties has been included in the instructional account, and such study hall cost has been distributed among the departments requiring study work in proportion to the number of credits attempted in these departments to obtain the cost per credit or in proportion to the number of pupil hours of work to obtain the cost per pupil hour. It seems to the writer that study hall supervision is a legitimate charge against the instructional account of the school, but it should not be charged against the department which a given teacher represents, for a teacher may be giving time to study hall out of all proportion to the needs of his department, as in the case of a manual training teacher who teaches his subject one-half day and is in charge of study assembly one-half day. His is a non-study subject and should have no study hall charges made against it.

In a few cases extra-class time has been checked on the reports, as for regular coaching of athletics or debate, where it was evident that this was a regular feature of the teacher's work and was considered in his schedule of hours or salary.

The time of this extra-class work is included in making up the teacher's weekly time, but the cost has not been entered because in the absence of credit or definite indication of the number enrolled it was impossible to compute the cost per credit or per pupil hour. In this report two cost bases have been used:

1. The pupil hour which is absolute and means the same quantitative amount in any school at any time. By this standard we can measure the cost of the same time unit of instruction, whether the year is long or short or the daily periods long or short. The limitation of this standard is that it is not the one of common usage in evaluating school work.

2. Cost per credit, which is the evaluation given for a semester's work in a subject having one daily recitation, or it represents 1-32 of a standard four-year high school course.

Owing to the fact that the school year varies in the schools listed from 32 to 40 weeks, and as class periods vary from 40 to 70 minutes, it is apparent that a credit is not a standard thing from the time viewpoint. But it is a standard from the college entrance standpoint within the State.

Before presenting the general summaries of my findings, I wish to present on the screen and discuss with you for a few minutes the more important factors entering into instructional costs.

The two major factors in instructional costs, as I see them, are teachers' salaries and the number of pupils instructed. Contributing factors are the length of the school year, number of teaching periods per day or week, and the size of classes, and the nature of the subject (whether laboratory, requiring double periods, or recitation, requiring single periods daily). While this latter factor does not count in cost per pupil hour, it does have great influence in the cost per credit of laboratory and shop subjects.

That I may emphasize the significance of the different cost factors I have attempted to select typical cases for comparison in which all but one of the factors are uniform or nearly so.

COST FACTORS

Exhibit 1. Salary factor.

Group II, School 11

	History	Modern Language
Salary	$1,056*	$900*
Class size	19.4	19.5
Credit periods	5	5
Teaching periods	30	30
Cost per credit	$4.93	$4.45

*Chief variable.

Exhibit 2. Class size factor.

Drawing and Art		
	Group II, School 2.	Group II, School 13
Salary	$810	$810
Class size	9.5*	35.*
Credit periods	10	10
Teaching periods	40	40
Cost per credit	$10.65	$2.88

Exhibit 3. Credit period factor.

Group II, School 10		
	Manual Arts	Mathematics
Salary	$1,025	$1,002
Class size	16	15.5
Credit periods	10*	5*
Teaching periods	39	43.6
Cost per credit	$8.22	$4.45

Exhibit 4. Teaching period factor.

Latin		
	Group II, School 5	Group I, School 1
Salary	$1,036	$1,038
Class size	17.7	17.1
Credit periods	5	5
Teaching periods	30*	25*
Cost per credit	$4.90	$6.46

Exhibit 5. Like variants.

Average of Group II		
	English	Mathematics
Salary	$855	$860
Class size	21	21.6
Credit periods	5	5
Teaching periods	32.3	35.1
Cost per credit	$3.56	$3.51

Exhibit 6. Opposing variants

Average cost per credit		
	Group I, School 1	Group III, School 10
Salary	$1,094	$665
Class size	15.8	20.8
Credit periods	.	...
Teaching periods	24.9	40.6
Cost per credit	$6.89	$2.60

Exhibit 7. Do like salaries produce like costs?

School —			
	Drawing	Science	History
Salary	$810	$810	$810
Class size	9.5	15.6	24.5
Credit periods	10	6.5	5
Teaching periods	35	29	36.5
Cost per credit	$10.65	$5.70	$2.66

Exhibit 1 shows in moderate degree the influence of varying salaries as a factor in cost production.

"Credit periods" refers to the number of single periods a class meets weekly to earn a credit in a half-year, while "teaching periods" refers to the number of single periods a teacher teaches weekly.

In Group II, School 11, it will readily be seen that the chief variable in the cost producing items is salary, and that the cost per credit varies approximately in proportion to the salary.

Exhibit 2 illustrates the influence of class size as a factor in cost production. In this exhibit all cost factors are identical except class size, and the costs per credit are exactly in inverse ratio to the size of classes.

Monroe, thru the use of coefficients of correlation, demonstrates that the size of classes is the major factor in instructional costs in the Kansas schools. This is due to the fact that salaries seldom vary more than 20 per cent or 25 per cent from the median, while class size frequently varies 50 per cent. This is the factor that deserves most attention in the standardizing process. An increase of $200 in salary may more than be offset by an increase of 3 or 4 in the size of each class for the average teacher. And with the standard class of nineteen, as our data show for these 34 schools, it is quite possible to increase the size by 5 or 6 and still have good working conditions.

Exhibit 3 illustrates the influence of the nature of the subject in cost production. The laboratory or shop subject with twice as many daily periods for class work essentially doubles the cost, other factors being equal. Other factors vary slightly, but in such a manner as to neutralize each other in this case.

Exhibit 4 shows the influence of the number of teaching periods daily or weekly in cost production. The size of the classes varies slightly, but accounts for but a small part of the cost variation. From this we might formulate the statement that, other factors being equal, the cost per credit varies inversely as the number of weekly teaching periods.

Exhibit 5 is intended to show the influence of approximately like factors. Like factors apparently produce like results.

Exhibit 6 offers a comparison of two systems in one of which, Group I, School 1, every factor tends to produce high costs and in the other, Group III, School 10, low costs as compared with a median standard.

In visiting an Indiana city this winter I made inquiry of the high school principal concerning his subject costs and was informed that he had no tabulated data, but that the cost of instruction in each subject was about the same, as their teachers' salaries were approximately equal.

I have selected in Exhibit 7 three subjects, drawing, science, history, from one school to show that the costs are not even approximately the same, altho the teacher's salary in each case is $810. You see that each of the other three cost factors are unlike and hence we should not expect like costs.

TABLE 1.—COST OF INSTRUCTION PER CREDIT

Group and School	Commercial	Drawing and Art	English	History	Household Arts	Latin	Manual Arts	Mathematics	Modern Languages	Music	Physical Training	Science	Average
Group I													
1	5.57	11.35	5.83	6.63	8.55	6.46	13.14	5.50	7.11	3.94		10.93	6.89
2	8.91	11.34	4.20	4.73	13.54	6.69	12.07	4.10	5.30	2.09	6.70	6.78	5.81
3	7.00	13.98	3.20	3.39	6.98	3.83	7.18	3.46	3.95	6.34	8.16	5.73	4.21
4	7.18	10.23	3.08	3.23	8.95	5.36	7.89	2.64	3.92			4.78	4.23
5	.	.	4.58	2.93	8.25	4.36	8.20	2.98	3.73			5.89	4.44
6	4.01	18.18	4.04	5.33	6.15	7.11	11.06	4.81	4.44	6.28	2.64	5.57	5.09
7	4.89	11.98	5.87	4.63	8.84	5.73	12.15	5.08	4.74	1.81	4.52	7.85	5.82
*M	6.28	11.67	4.20	4.68	8.55	5.73	11.06	4.10	4.44	3.94	5.11	5.89	5.09
*1Q	4.89	11.34	3.62	3.31	7.61	4.86	8.04	3.22	3.93	2.09	4.52	5.35	4.34
*3Q	7.18	13.98	5.20	5.03	8.90	6.58	12.11	4.94	5.02	6.28	6.90	7.32	5.82
Group II													
1	4.27		3.82	4.31	7.08	5.25	20.89	3.69	4.41	1.45		7.16	4.48
2	3.11	10.65	2.53	2.66	7.56	4.02	6.97	3.36	4.09	1.32		5.70	3.39
3	3.29	.	3.33	2.68	3.92	3.73	10.79	3.14	3.92			5.00	3.67
4		13.14	3.98	3.22	6.13	4.30	4.93	4.15	3.15	2.15		5.67	4.18
5	5.64	12.19	4.78	4.51	7.31	4.90	5.36	4.49	6.93	2.80	6.58	7.40	5.42
6	..	11.25	2.62	2.69	4.50	3.40	4.57	2.39	2.91	1.04		4.35	3.10
7	3.76	4.41	3.51	2.80	4.16	3.46	5.75	3.51	4.38		3.08	6.92	3.85
8	3.26	9.72	3.25	3.33	9.21	3.53	4.76	2.91	3.52		..	4.75	3.72
9	4.91		3.46	3.09	7.15	4.42	9.42	2.90	3.10	2.82		5.42	4.11
10	4.97	.	3.93	3.83	9.66	4.33	8.22	4.45	5.60	2.66		6.28	4.85
11	5.76	13.39	5.05	4.93	6.52	4.95	13.08	3.94	4.45	3.41		7.24	5.58
12	3.95	12.14	4.09	3.99	10.43	4.27	15.25	3.47	4.49	4.55	5.81	4.03	4.36
13	4.22	2.88	3.61	2.78	8.14	3.88	6.58	3.52	4.00	1.70		4.45	3.96
14	2.84		2.99	3.05	9.64	3.90	11.91	3.62	3.04	2.00		4.38	3.62
M	4.08	11.25	3.56	3.15	7.23	4.14	7.10	3.51	3.96	2.15	5.81	5.55	4.03
1Q	3.26	9.72	3.25	2.78	6.13	3.73	5.36	3.14	3.15	1.70	4.44	4.45	3.67
3Q	4.97	12.19	3.98	3.99	8.21	4.42	11.92	3.94	4.38	2.80	6.29	6.92	4.48
Group III													
1	..		3.13	3.12	9.05	3.93	6.38	3.74		1.37		5.43	4.26
2	5.12	3.21	3.39	3.35	5.36	2.99	6.43	3.65	2.80	1.60		5.19	3.61
3	...	....	3.49	2.97	6.19	6.75	...	3.26	4.46	..		6.19	4.26
4	4.63	....	4.83	4.94	6.47	6.23	5.45	4.69			.	8.08	5.74
5	3.47	4.57	3.09	3.37	2.76		9.18	3.13	8.28	1.52	.	7.01	4.20
6	..	...	3.95	6.24	...		..	3.04	3.74	2.48		5.09	4.05
7	10.00	...	4.30	4.26	7.05	4.86		6.55	4.17	..	...	8.34	5.31
8	4.50	8.76	2.82	4.09	3.53	5.25		2.51	....	1.94		3.84	3.49
9	11.33	.	9.24	14.44	7.61	11.03	14.06	9.82	..			15.50	10.83
10	2.23	8.98	2.21	2.17	7.60	2.67	6.81	2.40		2.57		3.43	2.60
11	..	7.95	7.97	5.56	14.87	8.35	12.50	10.00	.	8.42		13.29	8.09
12	2.94	6.70	2.72	2.79	9.07	8.29	14.41	3.50	3.67	2.27		2.87	4.00
13	9.65		3.78	2.92	13.05	5.64	...	3.84	3.93			4.75	4.19
M	4.63	7.33	3.49	3.37	7.60	6.23	7.99	3.65	3.93	2.10		5.43	4.20
1Q	3.47	5.63	3.09	2.97	6.19	4.86	6.43	3.13	3.70	1.60		4.75	4.00
3Q	9.65	8.35	4.30	4.94	9.07	6.75	12.50	4.69	4.32	2.48	..	8.08	5.31

*M represents the median; 1Q, the first quartile; and 3Q, the third quartile. 1Q and 3Q represent the boundaries of the middle fifty per cent of the cases or the "zone of safety".

TABLE 2.—COST OF INSTRUCTION PER 100 PUPIL HOURS (60 MINUTES)

Group and School	Commercial	Drawing and Art	English	History	Household Arts	Latin	Manual Arts	Mathematics	Modern Languages	Music	Physical Training	Science	Average
Group I													
1	4.69	9.57	4.92	5.62	7.19	5.45	11.07	4.69	5.99	3.35		8.70	5.81
2	[illegible]	[illegible]	5.87	6.71	9.50	9.28	8.47	5.64	7.33	1.47	4.71	7.44	6.91
3	7.18	12.97	5.03	5.33	5.55	6.04	5.70	5.44	6.22	10.09	6.50	6.04	5.82
4	6.48	8.12	4.87	5.10	7.11	8.49	6.26	4.18	6.20			6.10	5.84
5			7.23	4.62	7.12	6.89	6.51	4.70	5.90			7.25	6.19
6	3.82	17.32	3.85	5.08	5.86	6.77	10.53	4.58	5.94	5.99	2.51	5.45	4.85
7	4.41	8.87	8.76	6.88	7.86	8.50	9.00	7.45	7.01	3.01	3.35	6.72	6.78
M	5.59	9.22	5.03	5.33	7.12	6.89	8.47	4.70	6.20	3.35	4.03	6.72	5.84
1Q	4.54	8.50	4.87	5.10	7.11	6.77	6.51	4.69	5.99	3.01	3.35	6.10	5.82
3Q	6.83	11.27	5.87	5.62	7.19	8.49	9.00	5.44	6.22	5.99	4.71	7.25	6.19
Group II													
1	5.12		[illegible]	6.34	5.24	7.74	15.55	5.64	6.50	1.34		5.37	5.75
2	3.19	9.00	4.22	4.42	6.30	4.93	5.81	5.58	6.83	1.00		8.36	4.77
3	3.55		4.88	3.93	2.91	5.52	8.00	4.61	5.76			6.35	4.77
4		10.43	6.61	5.35	4.89	7.23	4.12	6.91	5.24	2.70		8.47	6.22
5	4.93	9.68	7.54	7.09	5.81	7.72	4.25	7.08	10.91	2.58	7.65	8.88	6.97
6		[illegible]	4.26	4.39	3.75	5.57	3.81	3.87	4.75	.90		4.81	4.25
7	2.98	[illegible]	5.52	4.40	[illegible]	5.46	4.91	5.59	6.96		2.57	8.00	5.12
8	5.42	8.17	5.41	5.54	7.74	5.87	3.97	4.84	5.86			5.28	5.53
9	7.84		5.47	4.88	6.07	7.00	7.45	5.36	4.90	2.23		7.26	5.82
10	4.76		5.90	5.74	7.66	6.49	6.09	6.66	8.38	1.26		8.13	6.04
11	[illegible]	8.40	[illegible]	6.90	4.57	7.00	9.16	[illegible]	6.21	4.82		8.82	7.08
12	7.14	8.99	6.06	[illegible]	15.69	5.99	9.74	5.13	[illegible]	4.58	4.30	5.56	5.92
13	[illegible]	[illegible]	5.85	4.37	6.46	6.10	5.23	5.56	6.36	[illegible]		5.68	5.49
14	5.12		4.43	4.52	7.14	5.77	8.86	5.35	4.49	1.63		6.04	5.03
M	[illegible]	9.00	5.58	5.12	5.94	6.05	5.95	5.53	6.28	1.63	4.30	6.80	5.64
1Q	4.76	8.17	4.88	4.42	[illegible]	5.57	4.91	5.13	5.24	1.34	3.43	5.56	5.03
3Q	7.12	9.40	6.06	5.90	6.46	7.00	8.86	5.64	6.83	2.58	5.97	8.36	6.04
Group III													
1			5.69	5.73	8.48	7.21	[illegible]	6.73		1.29		7.63	6.57
2	7.52	2.66	4.76	4.49	4.17	4.03	5.32	4.98	3.57	2.66		7.33	4.65
3			5.16	4.41	5.09	10.00		4.84	6.75			8.73	6.00
4	8.90		9.68	9.33	15.44	11.74	5.12	8.83				13.42	10.23
5	6.10	4.03	5.41	5.89	2.60		7.94	5.48	[illegible]	1.72		9.28	6.07
6			4.73	11.93				5.77	7.09	2.32		9.54	7.11
7	16.42		7.17	7.05	5.88	8.12		10.95	5.91			14.23	9.14
8	8.42	8.25	5.30	7.68	4.15	9.84		4.71		3.67		5.67	5.98
9	21.21		17.36	27.08	7.14	20.57	13.26	18.46				29.69	16.96
10	4.16	8.41	4.13	[illegible]	7.07	5.00	6.39	4.49		2.80		6.22	4.60
11		7.45	14.88	10.42	13.94	15.35	11.72	18.38		16.00		8.97	13.41
12	5.23	1.48	4.82	4.97	8.06	14.67	12.72	6.22	6.52	1.00		5.10	5.13
13	18.30		6.07	5.47	12.41	10.61		7.44	7.35			7.96	7.63
M	8.42	5.74	5.41	5.89	7.10	10.00	7.16	6.22	6.75	2.49		8.73	6.37
1Q	6.10	[illegible]	4.82	4.97	5.09	8.12	6.00	4.98	6.20	1.72		7.33	5.98
3Q	16.42	7.85	7.17	9.33	8.48	11.74	11.72	8.83	7.22	2.80		9.54	9.14

The following table (3) shows a comparison of medians of the schools of Groups I and II combined, with the medians of the 25 schools of Dr. Bobbitt's study.

TABLE 3.—COST OF INSTRUCTION PER 100 STUDENT HOURS

	Commercial	Drawing and Art	English	History	Household Arts	Latin	Manual Arts	Mathematics	Modern Languages	Music	Physical Training	Science	Total
Indiana (21 schools)...	5.12	9.00	5.52	5.33	6.30	6.49	6.51	5.44	6.21	2.40	4.30	6.72	5.82
Bobbitt (25 schools)...	6.90	......	5.10	6.20	6.10	7.10	9.20	5.90	6.30	2.30	.....	6.00	6.20

COST OF INSTRUCTION

How much should a community pay for a half-year's instruction in each of the most commonly offered subject groups? On the basis of general principles, costs should depend upon the educational and practical values of the subject, but educational fashions, no doubt, exercise an appreciable influence. What community standards of judgment are I do not know, but Table 1 shows the prices paid by each of the 34 schools coöperating in this study for each credit attempted. Table 2 shows the cost per 100 student-hours for the same subjects and schools. One hundred hours of instruction is equivalent to 7 school months or to 143 recitation periods of 42 minutes each.

Schools designated as Group I have 500 or more pupils or are located in cities of more than 20,000 population. Those of Group II have 200 to 499 pupils or are located in cities of from 4,000 to 10,000 population; while schools of Group III have less than 200 pupils.

All the schools in Group I and all but one in Group II are members of the North Central Association of Colleges and Secondary Schools. But one school in Group III is a member of this association. The schools of Groups I and II have an average session of more than 36 weeks per year, while those of Group III average about 32 weeks a year.

The schools within any group may be considered to be approximately equal in aims and standards. No doubt inequalities exist, but it may be seriously questioned whether there is any correlation between high costs and superior quality of product. The differences in cost are probably due largely to the application or the non-application of the best administrative standards. Within practically every subject within every group some school is paying twice as much per credit or per 100 student-hours as is some other school of that same group. Nor is this wide variation confined to the newer subjects of the program, but is equally apparent in English, history, and mathematics. Reference to Table 1 reveals the following extreme variations in the cost per credit of certain subjects in the schools of Group I: commercial, \$4.01 to \$8.91; history, \$2.93 to \$6.63; household arts, \$6.15 to \$13.54; mathematics, \$2.64 to \$5.50; music, \$1.81 to \$6.34; and science, \$4.78 to \$10.33.

Not only is there great variation in costs between schools of the same group for any subject, but on examination of Table 1 (Group II medians) great variation is evident between the median costs of different subjects, ranging from \$11.25 for drawing to \$2.15 for music, with foreign languages and commercial subjects occupying a median place and manual arts costing about twice as much as English or mathematics. The low cost of music is accounted for by the excessively large class size. Classes of under 30 in music were given .2 credit for every class period a week where it was apparent from the description of the course that some study was required outside the class period. Larger classes and chorus groups were given .1 credit unless otherwise specified in the report of the school.

In Tables 1 and 2 the median costs are computed for each subject and for each group of schools. Table 1 should be read as follows: School 1 of Group I is paying \$5.83 per credit for instruction in English, and \$6.89 on the average for all subjects combined. The median school of Group II is paying \$3.15 per credit for history instruction, and the zone of safety lies between \$2.78 and \$3.99. Blank spaces in the tables indicate that no classes in these subjects were reported by these schools.

While it is neither practicable nor desirable that every school conform to its group median, yet the suggestion offered by Dr. Bobbitt* may well be given serious consideration, namely: to keep the costs within the limits of these of the middle 50 per cent of the group, which limits he designates as the "Zone of Safety".

Table 1 shows that English, history, and mathematics have

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*"High School Costs", *School Review*, Oct., 1915

the lowest costs (if music be excluded) while Table 5 shows that these and commercial are the only subjects that have a median class size of more than 20 pupils.

The cost per 100 student hours is more uniform from subject to subject than is the cost per credit, for the latter requires daily double periods in some of the subjects while only single periods in such subjects as English and mathematics. This difference in costs on the two bases may be illustrated by contrasting household arts and Latin in the medians of the schools of Group II. On the credit basis, household arts costs $7.23 and Latin $4.14; while on the 100 student-hour basis, household arts costs $5.94 and Latin $6.05. For equal teaching time, household arts costs less than Latin, but for a credit on the school records, it costs 75 per cent more.

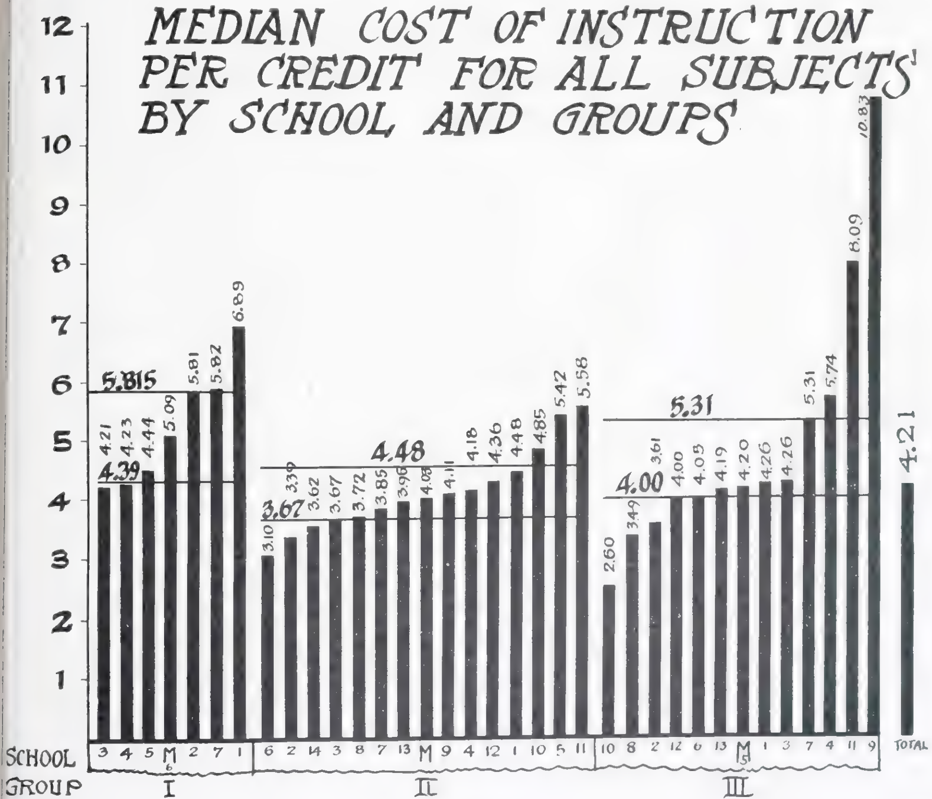

FIG. III.

Figure III represents graphically the cost per credit for all subjects combined for each school, and includes also group and total medians. "M" indicates the medians, and the horizontal lines drawn across the cost bars indicate the limits of the zones of safety.

The twelve subject groups, used thruout this report at the top of each table involving subjects, are as follows: Commercial, drawing and art, English, history, household arts, Latin, manual arts (including mechanical drawing, shop work, printing, etc.), mathematics, modern languages, music, physical training, and science (including agriculture).

TABLE 4.—AVERAGE SALARIES OF TEACHERS

Group and School	Commercial	Drawing and Art	English	History	Household Arts	Latin	Manual Arts	Mathematics	Modern Languages	Music	Physical Training	Science	Average
Group I													
1	1,009	1,050	1,189	1,048	855	1,038	1,211	1,020	1,100	1,100		1,300	1,094
2	1,062	900	917	900	910	874	928	852	916	1,000	900	1,113	948
3	786	990	846	867	846	888	814	821	884	990	810	1,012	885
4	900	900	865	855	853	885	900	870	890		..	868	892
5	.	.	925	900	832	833	878	829	930	..		861	878
6	886	1,200	960	1,088	1,033	979	985	1,005	926	1,500	1,070	1,204	1,008
7	962	968	1,036	1,030	900	1,080	1,269	1,057	1,101	1,350	1,278	1,151	1,065
M	931	979	925	900	855	888	928	870	926	1,100	985	1,113	948
Group II													
1	805		833	756	850	780	1,087	810	821	850		936	839
2	810	810	826	810	810	900	1,100	898	810	810		810	857
3	890	...	815	919	675	810	907	810	810			960	840
4		920	826	1,100	756	920	810	981	756	850	..	1,000	905
5	1,036	1,036	985	1,161	1,036	1,036	1,200	1,111	936	1,061	806	1,112	1,046
6	.	720	855	752	720	765	720	830	756	720		882	800
7	810	900	860	810	818	859	1,200	904	810		720	874	880
8	680	680	709	900	695	765	680	680	680			680	707
9	765	...	796	765	727	765	810	801	810	810	.	785	785
10	1,082	..	791	930	850	943	1,025	1,002	800	810		1,025	921
11	1,024	1,500	950	1,056	950	950	1,300	1,011	900	900		1,000	1,003
12	1,168	765	943	1,155	945	945	1,000	1,046	945	765	650	1,008	1,000
13	810	810	814	765	765	800	810	833	810	720	..	810	808
14	828	...	787	773	540	765	810	810	765	1,012		841	782
M	819	810	826	855	787	835	953	860	810	810	720	909	849
Group III													
1	.		701	713	800	722	800	744	..	960		904	790
2	900	675	810	841	765	720	855	810	720	675		855	798
3	920		810	800	640	1,000		920	640			802	813
4	680	..	680	834	900	900	800	800				748	795
5	680	510	850	1,000	213		680	850	850	510		911	734
6			700	668			..	600	800	700		732	700
7	800	...	734	749	626	700	...	763	700	.	..	800	730
8	504	560	566	720	672	672	..	504	.	560		644	609
9	800	..	640	723	640	900	900	800			.	800	756
10	700	680	680	800	680	709	600	610	.	680	.	720	665
11	...	714	684	800	714	584	800	800		640	.	615	707
12	670	670	716	670	580	595	692	1,050	716	508		815	712
13	920		810	800	640	1,000		920	640			802	813
M	700	672	701	749	676	720	800	800	720	658		800	734

TEACHERS' SALARIES

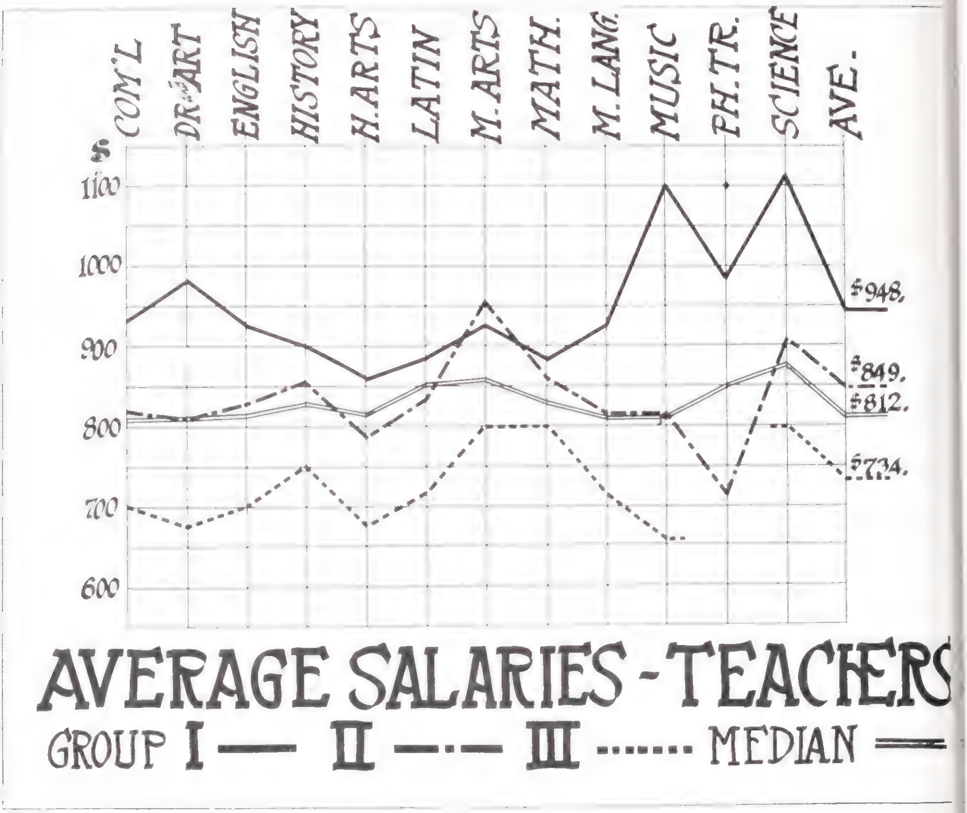

FIG. IV.

Table 4 and Figure IV show the average annual salaries paid in each department of work for each school. The median results are indicated for each group. The table should be read as follows: School 5 of Group II is paying an average salary of $1,161 for its history teachers, $1,200 in manual arts, $1,112 in science. Also the schools of Group I are paying a median salary of $948; Group II, $849; and Group III, $734.

Salaries seem to vary with the size of the school if we may judge by group medians. However, an analysis of the original data for the schools of Group III shows that monthly salaries are as high as in Group II, the annual differences being due to the difference in the length of the term in the two groups. The medians of Group II show that manual training and science teachers receive the highest salaries, $953 and $909, respectively. No doubt the higher salaries in these departments are due to the fact that these positions are generally occupied by men. Omitting physical training, which has but three representatives in Group II, household arts teachers are paid the lowest salaries ($787), while teachers of Latin, history, and mathematics are paid about the median salaries for this group. In Group I, science and music pay the highest salaries; household arts, mathematics, and Latin, the lowest salaries; and the remaining seven subjects pay about median salaries. In Group III the highest salaries are in science, manual training, and mathematics; the lowest in music, drawing, and household arts; while the remaining subjects of this group pay about median salaries.

More noticeable than salary differences in Group II are salary uniformities by departments. These figures give but little guidance to the prospective teacher who is desirous of entering the field offering the greatest financial rewards. The higher salaries are paid in the schools of Group I. Teachers should prepare to teach in schools of this group not only because of higher salary, but also because of fewer teaching periods a week and because teachers in this group tend to specialize in one subject instead of teaching two to five subjects as Table 12 shows to be the condition in schools of Group III.

These figures differ slightly from those of Bobbitt,* who found that teachers of shop work and music received the highest salaries; science teachers about the median salary; and modern languages and household arts, the lowest. The schools reported in his study correspond to those of Groups I and II of this investigation. Monroe† found agriculture, manual training, and science paying the highest salaries, and English and household arts, the lowest.

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*"High School Costs". *School Review*, Oct., 1915.

† "Cost of Instruction in Kansas High Schools". Published by the State Normal School, Emporia, Kan.

SIZE OF CLASSES

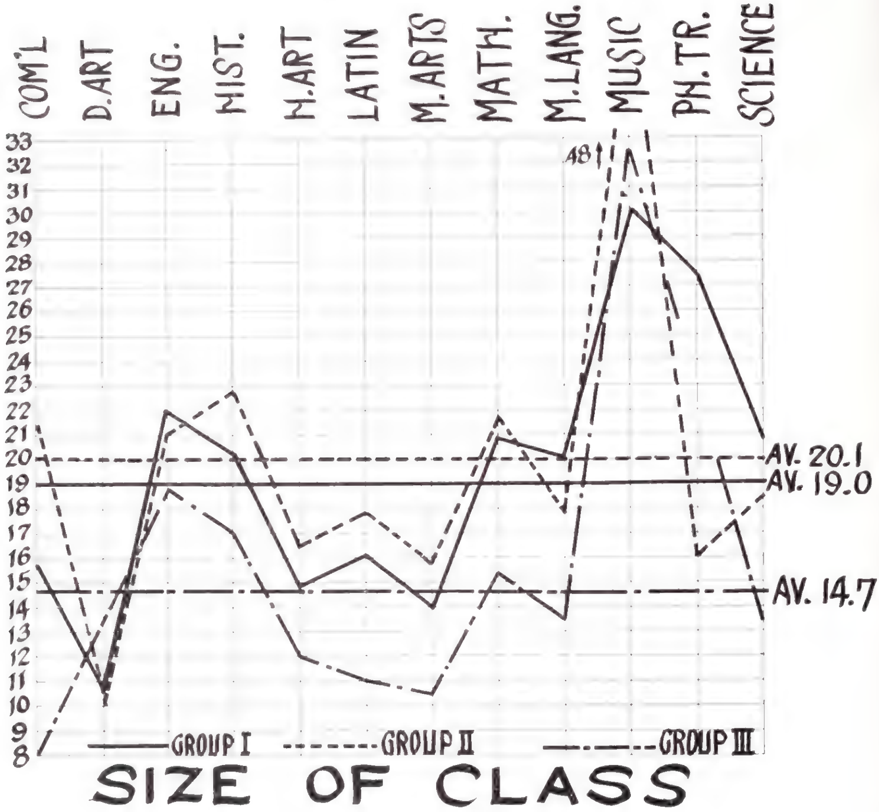

FIG. V.

TABLE 5.—AVERAGE SIZE OF CLASSES

Group and School	Commercial	Drawing and Art	English	History	Household Arts	Latin	Manual Arts	Mathematics	Modern Languages	Music	Physical Training	Science	Average*
Group I													
1	18.1	9.2	21.5	16.9	11.3	17.1	9.2	18.8	16.4	28.0	...	12.6	15.8
2	13.5	11.3	23.7	18.5	9.6	12.2	11.5	20.9	17.9	68.3	19.2	21.8	17.7
3	12.5	9.1	22.1	20.4	22.0	18.8	15.8	19.9	19.9	9.8	14.2	20.2	19.0
4	11.0	14.6	22.3	21.7	14.8	14.9	19.0	25.5	19.9	...		20.6	19.8
5	...	...	20.2	26.7	10.5	16.1	13.9	24.0	22.6	...	...	22.0	19.7
6	22.1	6.8	23.8	20.4	16.8	13.8	10.2	20.9	22.4	30.3	35.6	20.4	18.2
7	31.1	13.4	21.0	21.1	15.0	18.0	15.4	20.6	21.1	62.0	39.8	21.3	20.5
M.	15.8	10.2	22.1	20.4	14.8	16.1	13.9	20.9	19.9	30.3	27.4	20.6	19.0
Group II													
1	21.1	...	22.8	17.0	20.0	15.0	8.0	22.3	18.4	97.5		21.1	20.4
2	19.3	9.5	24.6	24.5	13.7	23.8	14.6	23.7	15.2	146.7	...	15.6	20.1
3	28.7	...	21.5	28.5	21.5	17.3	11.2	20.9	15.5	...		18.0	20.8
4	...	10.0	19.7	34.0	18.3	18.0	22.5	20.3	22.0	37.5		17.6	21.9
5	23.3	12.0	18.6	21.8	19.7	17.7	28.0	20.5	10.8	66.0	13.3	19.0	19.1
6	...	8.0	26.2	21.5	20.0	20.0	17.5	31.6	22.8	87.0		21.5	23.3
7	24.5	27.0	21.3	23.5	24.8	20.1	22.7	22.8	17.0	...	29.2	15.4	21.3
8	18.0	10.0	21.6	27.0	10.3	18.4	18.0	22.5	16.4	...	...	21.8	20.1
9	14.3	...	20.8	22.2	14.7	14.4	14.3	20.4	23.4	48.0	...	17.4	19.0
10	12.6	...	17.1	18.8	11.0	16.4	16.0	15.5	11.8	38.0		15.0	15.1
11	21.2	14.5	17.5	19.4	21.5	18.2	15.4	24.9	19.5	22.0		12.9	18.6
12	25.6	9.0	20.0	24.0	13.0	22.5	11.0	22.4	20.0	28.5	16.0	22.3	21.1
13	15.5	35.0	20.3	25.4	13.3	16.7	16.5	20.2	16.2	47.3		20.3	19.2
14	24.7	...	25.8	21.8	7.0	15.9	8.5	18.3	18.5	65.5		20.2	20.0
M.	21.2	10.0	21.0	22.8	16.5	17.8	15.7	21.6	17.7	48.0	16.0	18.5	20.1
Group III													
1	...	...	20.1	19.5	13.0	15.0	15.7	15.3		87.5	...	14.6	16.4
2	13.0	25.0	19.6	21.3	17.8	20.5	17.5	17.8	22.5	25.0	...	13.6	19.5
3	...	...	24.7	23.7	19.0	11.0	...	22.0	18.2	...		18.8	20.0
4	13.0	...	12.2	13.6	5.5	11.0	17.0	14.0	...	...		8.0	11.6
5	16.0	16.0	21.3	22.0	12.0	...	10.0	21.0	3.0	48.0		10.5	15.5
6	...	...	13.0	7.3	...	...	...	12.3	13.3	40.0		9.0	11.0
7	5.0	...	10.7	11.0	12.0	9.0	...	7.7	10.5	...		6.0	9.2
8	8.0	8.0	13.6	11.0	20.0	8.0	...	14.3	...	18.0		14.0	12.1
9	6.0	...	7.3	4.3	12.0	7.0	8.0	7.3	...	...		4.0	6.7
10	25.0	9.0	25.2	30.0	10.7	20.2	11.0	22.8	...	54.0	...	16.8	20.8
11	...	15.0	5.8	9.0	8.0	5.0	8.0	5.0	...	19.0		7.0	6.9
12	16.0	12.5	18.8	17.0	8.0	4.6	6.0	20.6	13.3	16.0		20.0	14.7
13	7.0	...	19.1	26.6	7.0	14.6	...	19.6	14.5	...		17.0	17.4
M.	8.0	13.7	18.8	17.0	12.0	11.0	10.5	15.3	13.3	32.5		13.6	14.7

*Music and Physical Training omitted in computing average.

TABLE 6. NUMBER AND PER CENT OF LARGE AND SMALL CLASSES

Group and school	Total number classes	Number classes 10 or less	Number classes more than 30	Per cent classes 10 or less	Per cent classes more than 30
Group I					
1	123	27	4	22.0	3.2
2	139	26	3	19.0	2.0
3	120	10	0	8.3	0.0
4	109	10	1	9.2	.9
5	106	13	7	12.3	6.6
6	190	45	19	23.7	10.0
7	243	23	33	9.5	13.6
Average	147	22	9.6	14.5	6.5
Group II					
1	85	8	3	9.4	3.5
2	68	7	8	10.3	11.8
3	89	5	4	5.6	4.5
4	35	2	2	5.7	5.7
5	57	8	4	14.0	7.0
6	39	0	9	0.0	23.1
7	97	4	9	4.1	9.3
8	41	3	2	7.3	4.9
9	50	2	2	4.0	4.0
10	52	10	1	19.2	1.9
11	74	9	3	12.2	4.1
12	53	4	0	7.5	0.0
13	57	3	4	5.3	7.0
14	54	8	6	14.8	11.1
Average	60	5.1	4	8.5	6.7
Group III					
1	48	9	3	18.7	6.2
2	28	1	2	3.5	7.0
3	31	5	3	16.1	9.7
4	18	8	0	44.4	0.0
5	22	4	4	18.2	18.2
6	17	7	0	41.2	0.0
7	16	12	0	75.0	0.0
8	21	7	0	33.3	0.0
9	15	13	0	86.7	0.0
10	36	3	4	8.3	11.1
11	13	12	0	92.3	0.0
12	25	6	0	24.0	0.0
13	30	5	0	16.7	0.0
Average	24.4	7.1	1.2	28.8	5.3

TABLE 7.—NUMBER AND PER CENT OF VERY SMALL AND VERY LARGE CLASSES BY GROUPS AND SUBJECTS

Class Items	Commercial	Drawing and Art	English	History	Household Arts	Latin	Manual Arts	Mathematics	Modern Languages	Music	Physical Training	Science	Average
Group I													
Total number classes	97	43	178	106	63	79	81	141	90	23	46	93	1,040
Number classes 10 or less.	18	30	8	5	19	15	32	6	7	3	2	9	154
Number classes more than 30	15	0	6	2	1	0	0	2	2	12	24	3	67
Per cent classes 10 or less....	14.8	70.0	4.5	4.7	30.2	19.0	39.5	4.3	7.8	13.0	4.3	9.7	14.5
Per cent classes more than 30	14.2	0.0	3.4	1.9	1.6	0.0	0.0	1.4	2.2	52.2	52.2	3.2	6.5
Group II													
Total number classes	73	13	180	84	45	87	37	135	75	24	17	83	853
Number classes 10 or less....	7	5	2	1	7	11	12	7	8	3	1	9	73
Number classes more than 30	9	1	13	8	2	0	0	4	2	13	4	1	57
Per cent classes 10 or less.	9.6	38.5	1.1	1.2	15.5	12.6	32.5	5.2	10.7	12.5	5.9	10.8	8.5
Per cent classes more than 30	12.3	7.7	7.2	9.5	4.4	0.0	0.0	3.0	2.7	54.1	23.5	1.2	6.7
Group III													
Total number classes......	8	10	67	36	21	36	11	50	19	16		45	319
Number classes 10 pr less....	4	2	13	10	6	20	4	12	5	0		16	92
Number classes more than 30	0	3	1	2	0	1	0	1	0	8		1	17
Per cent classes 10 or less.	50.0	20.0	19.4	27.8	28.6	55.6	36.4	24.0	26.3	0.0		35.6	28.8
Per cent classes more than 30	0.0	30.0	1.5	5.5	0.0	2.8	0.0	2.0	0.0	50.0		2.2	5.3

Table 5 and Figure V show the facts relative to size of classes which is, perhaps, the most important factor in cost production.

Music and physical training have been omitted from the school averages in computing the right-hand column of the table, the latter, because of its rare occurrence and its wide variability, and the former, because of its excessive variation (13 to 147). When music classes are included, the average class size of a school is often raised by 5 or 10, due to the fact that some of these chorus groups often total 150 to 200 pupils. The average size of music classes is about two and one-half times that of other classes considered collectively.

Every group exhibits wide variations in size of classes in different departments. The only subjects that seem to have attained a standard favoring a moderate cost are English, history, and mathematics. These are the only subjects, aside from music, that have an average size of 20 pupils or more in all groups combined. Drawing, household arts, and manual arts classes are far below average size in all groups. These subjects have highly desirable values, but it may be honestly doubted whether they are worth from two to four times the other subjects of the curriculum as appears in Table 1.

The average class size is small in Group III because of the small total enrollment in these schools, one of the number having as few as 20 pupils. But few teachers enter the service of schools in Groups I and II without at least two years of teaching experience. Graduation from a standard college and some professional training are also the rule. In the light of these facts, it does not seem unreasonable to the writer to standardize the average class in these schools at 24 or 25 pupils instead of at 19 or 20. The difference in costs would be a very material one.

Why have standard class groups of 10 or 15 as in the case of the subjects of drawing, household arts, and manual arts? The elective system, no doubt, accounts for it in part, but other elective subjects are standardized at a much higher level. The argument for small classes for the purpose of individual instruction applies no more to drawing than to English.

A better administration of the elective system will tend to greatly reduce costs. To illustrate variable administrative practice in the same school, an example from one of the largest schools reporting is here given. In this school 8 Latin courses are offered, but in the 12B grade only 6 pupils are enrolled for Latin, and in the 12A grade but four. One teacher is giving more than one-third her time to 10 pupils at a cost of about $13 a credit. In the German department of the same school the 12A and 12B grades are combined for fourth year German, and the 12 pupils here enrolled receive instruction at a cost of $6 per credit. Economical administrative practice would indicate that in many subjects having small classes there should be an organization on the year rather than on the half-year basis, and in the smaller schools there should be an alternation of courses in the eleventh and twelfth grades. One school reporting has 6 half-year courses in household arts with not more than 8 pupils in any class. In such a situation it would seem quite possible to effect a reorganization providing for 3 classes with 15 or 16 pupils per class. The cost of one full-time teacher would be thus saved. In certain cases where very small classes are unavoidable, arrangements might be made to have each class recite for a period of 20 or 25 minutes instead of 45. Two such short-period classes could be considered as the equivalent of one regular class in the assignment of the teacher's time. One school of Group I has 20 classes in drawing and art and every class has an enrollment of 10 or less. Here again one-half the cost could be saved by doubling the class size, which would seem to be entirely possible in a school of this size without in any way reducing the number of courses offered.

Table 6 shows the number and per cent of classes having 10 or less pupils or more than 30, by schools and groups. The table should be read as follows: School 1 of Group I has 123 classes of which 27, or 22 per cent, have 10 pupils or less, and 4 classes, or 3.2 per cent, have more than 30 pupils.

The high per cent of very small classes in Group III (28.8) is due to the small enrollment in these schools; while the fairly high per cent (14.5) in Group I is due in part to the great variety of electives offered, but is also the result of poor administrative practice referred to above. The variations in administrative practice are great within any group. For example, school 6 of Group I has 23.7 per cent of very small classes, while school 3 has but 8.3 per cent. In Group II school 10 has 19.2 per cent of very small classes, while school 6 has none. In Group III school 11 has 92.3 per cent of small classes, and school 2 has 3.5 per cent. With respect to classes of more than 30 pupils, Group I has a range from 0 per cent to 13.6 per cent; Group II, 0 per cent to 23.1 per cent; and Group III, 0 per cent to 18.2 per cent.

Table 7 indicates the number and per cent of very small and very large classes by groups and subjects. The table should be read as follows: In Group II there are 73 classes reported in commercial subjects of which 7, or 9.6 per cent, have 10 or less pupils, and 9, or 12.3 per cent, have more than 30 pupils. In Group II, 7 of the 12 subjects (drawing, household arts, Latin, manual arts, modern language, music, and science) have more than 10 per cent of their classes with 10 or less pupils. In two of these subjects (drawing and manual arts) more than 20 per cent of the classes have 10 or less pupils. Seventy per cent of drawing classes in Group I have 10 or less pupils. Commercial subjects, music, and physical training show a high per cent of oversize classes, but as physical training is reported from but 3 of the schools of this group, it can hardly be said that this subject contributes much in the way of oversize classes to the total situation.

Table 8 indicates a fairly close agreement as to standard size of classes whether the schools be in Indiana, Kansas, or in schools of several of the central States.

Table 8 shows a comparison of medians of Groups I and II of this study with medians as determined by Bobbitt for 25 cities, and medians found by Monroe for 54 Kansas cities of the first and second class.

TABLE 8. SIZE OF CLASSES

	Commercial	Drawing and Art	English	History	Household Arts	Latin	Manual Arts	Mathematics	Modern Languages	Music	Physical Training	Science	Average
Indiana (21) Childs	20.3	10.0	21.5	21.8	14.8	17.3	15.4	20.9	18.5	47.7	19.2	20.2	19.7
Central States (25) (Bobbitt)	19.0	18.0	22.0	21.0	17.0	17.0	14.0	21.0	17.0	58.0	32.0	20.0	19.0
Kansas (54) (Monroe)	19.0		21.8	21.5	15.5	15.3	13.5	21.8	15.7			19.7	19.0

TABLE 9.—NUMBER OF CLASS PERIODS A WEEK PER TEACHER

Group and School	Commercial	Drawing and Art	English	History	Household Arts	Latin	Mathematics	Manual Arts	Modern Language	Music	Physical Training	Science	Average
Group I													
1	22.5	25.0	25.0	25.0	22.5	25.0	25.0	25.9	25.0	25.0		25.0	24.9
2	35.0	35.0	31.7	33.9	35.0	32.2	33.5	34.6	31.0	35.0	35.0	31.7	34.2
3	36.5	40.0	37.5	40.7	33.5	38.6	40.0	38.3	35.0	40.0	35.0	38.0	38.2
4	37.5	30.0	36.6	35.0	32.3	30.0	40.0	38.0	31.4			30.7	34.9
5.....			28.7	37.3	37.0	35.0	37.5	37.3	33.6			28.3	33.5
6.....	25.	25.	25	25.	25.	25.	24.	25.	25.	28.	28.4	26.4	25.1
7	33.1	28.0	23.5	28.0	28.2	28.2	31.7	29.3	30.7	30.0	35.5	29.9	28.4
M........	34.0	29.0	28.7	33.9	32.3	30.0	33.5	34.6	31.0	29.0	35.0	29.9	33.5
Group II													
1	30.6		28.4	30.8	30.0	28.6	30.0	30.3	30.1	24.0		30.8	29.8
2	35.0	40.0	37.0	38.5	40.0	38.5	40.0	33.2	38.5	40.0		29.0	35.9
3....	39.0		32.3	35.0	40.0	34.4	36.7	35.3	35.0			36.3	35.5
4....		35.0	32.1	35.0	35.5	35.2	36.0	35.0	35.0	35.0		32.0	34.0
5....	30.0	35.0	32.4	30.0	36.	30.	40.	36	35.	35.	29	29.4	33.2
6		40.	41.8	43.2	40	35.	45.	38.4	37.	40.		45.6	41.5
7	44.	40.	31.8	36	40.	35.	45.	31.9	30		40	30.4	34.6
8	35.	35.	30.5	30.	36.5	35.	40.	32	35.			32.6	32.4
9	30		33.5	35.	30.4	35.	30.	35.5	30.	30		33.8	33.3
10	46.		36.2	40.	37	40.	39	43.6	35.	40		39	39.5
11	33.4	35	30.5	30	30.	30	30	30.6	30.	30		35.	31.0
12	36.	35	33.8	35.	35.	30.	35.	40.	30.	35	35	36.5	34.8
13	37.5	40	34.8	37.	35.	38.	40.	37.1	38.	40		30	36.3
14	33.1		30.	34.	40.	35.	40.	35.	40.	35		30.7	34.3
M	35.	35	32.3	35.	36.2	35	39.5	35.1	35.	35	35	32.3	34.4
Group III													
1			40	40.7	34	39.6	40	43		40		44.	40.6
2	40	42	40	39	40	40	38	40	40.	42		38.	39.6
3.....			30	35.	31	31.		38	29.8			29.	31.5
4	40.		40	42.7	42	42.	43	43				42.	41.7
5	37	35	40	41.	30		37	40	40	35		40.1	40.0
6			34.9	36.5				40	40	35		40.	38
7	40.		40	40.	37	40		38	40			40	39.3
8	35	40	37	40.	38	40		35		40		40	38
9	40.		35	36.5	35	40	40	40				40	37.7
10.....	38.4	42	42	42.2	42	42.1	40	37.3		42		40	40.6
11.....		30	37.3	40.	30	35	40	40		40		35.7	34.7
12.....	40.	40	40	40.	40	40	40	40	40	40		40	40
13.....	37.		35.2	35	35	35		37	35			35.6	35.5
M	40	40.	40	40.	36	40	40	40	40	40		40.	39.3

Number of Class Periods

Table 9 and Figure VI show the number of class periods a week per teacher by subjects, schools, and groups. The average number of class periods a week is greater in the small schools than in the large schools.

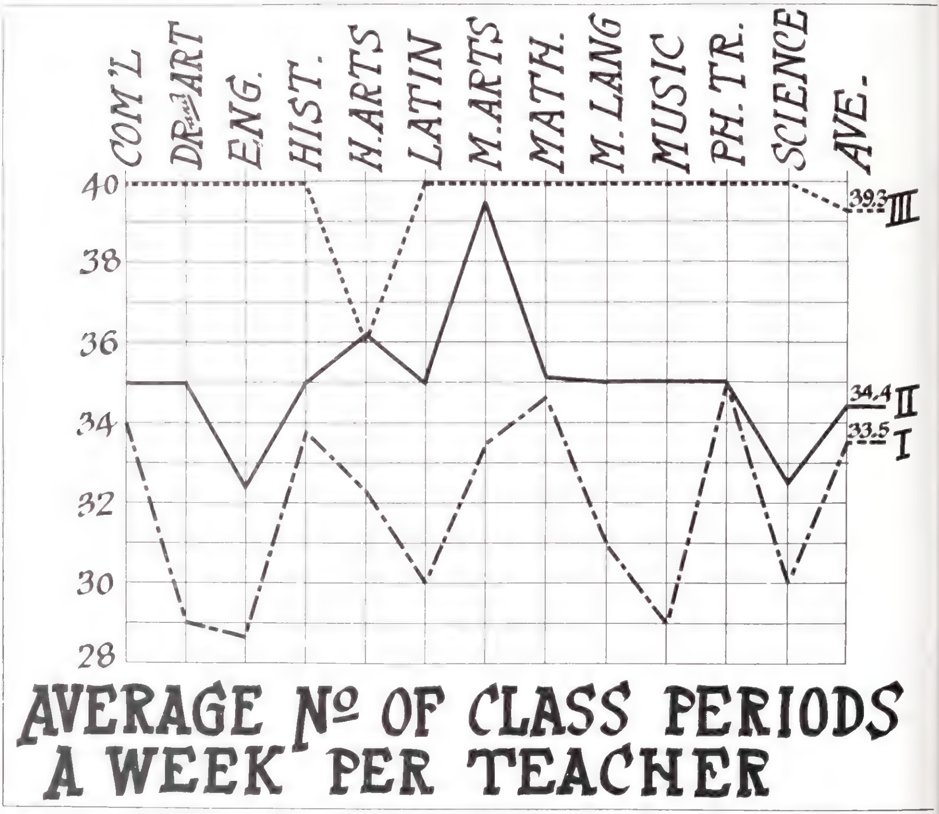

Fig. VI.

Schools 1 and 6 of Group I show a small number of class periods a week per teacher, and reference to Table 6 shows these schools to have the largest number of class hours a week per teacher. This is accounted for by the fact that these schools have combined recitation and supervised study periods of 75 and 70 minutes, respectively. The teachers in these schools are practically free from special conference hours which are generally required in high schools as extra time.

Reference to Table 14 in connection with Table 9 indicates that thirty periods a week is the standard teaching time in the schools of Groups I and II. The excess shown in Table 9 represents assembly and extra-class assignments. In Group III the weekly teaching time is about 35 periods, with 5 periods for assembly duty.

The tendency in schools of Groups I and II to require less class work of the English teachers than the average for other departments is commendable in view of the theme work of the English teachers. Just why the subject of drawing in Group I, which has a moderate salary cost and an average class size of 10, should also be one requiring a small number of class periods a week, I am unable to say. Such subjects as drawing and music require the least outside preparation and work on the part of the teacher and should be given a maximum of classroom periods weekly rather than a minimum.

A standard of 30 teaching periods a week and 5 assembly periods would seem to be the highest maximum desirable for schools of Groups I and II. As a matter of fact, the North Central Association at its recent meeting fixed this as a maximum standard because this was the generally accepted standard in practice and it was thought that a few accredited schools were requiring too many periods of extra-class work from their teachers to maintain the highest standards of efficiency in preparation. For economic reasons the standard for schools of Group III will probably best remain at 40.

TABLE 10. NUMBER OF CLASS HOURS A WEEK PER TEACHER

Group and School	Commercial	Drawing and Art	English	History	Household Arts	Latin	Manual Arts	Mathematics	Modern Languages	Music	Physical Training	Science	Average
Group I													
1	30.6	31.2	31.2	31.2	[illegible]	31.2	31.2	32.4	31.2	31.2		31.2	31.1
2	26.3	26.3	[illegible]	25.5	26.2	[illegible]	25.1	26.0	23.2	26.3	26.3	23.8	25.6
3	25.6	28.0	27.7	28.5	23.5	27.0	28.0	26.8	24.5	28.0	24.5	26.6	26.7
4	26.2	21.0	25.4	21.5	22.6	21.6	28.0	26.6	22.1			21.5	24.1
5			20.1	26.1	25.9	24.5	26.3	26.1	23.5			19.8	23.5
6	29.2	29.2	29.2	29.2	29.2	29.2	28.0	29.2	29.2	35.1	36.2	30.8	29.3
7	24.8	21.0	17.6	21.0	[illegible]	[illegible]	23.8	22.0	23.0	22.5	26.6	22.5	21.3
M	26.2	27.1	25.4	26.1	25.9	24.5	28.0	26.6	23.5	28.0	26.5	23.8	25.6
Group II													
1	23.0		21.3	23.1	[illegible]	21.4	22.5	22.7	22.6	18.0		23.1	22.4
2	23.3	26.7	24.7	25.7	26.7	25.7	26.7	22.1	25.7	26.7		19.3	23.9
3	29.2		24.2	26.2	30.0	25.8	27.5	26.5	26.2			27.2	26.6
4		23.3	21.4	23.3	23.7	23.5	24.0	23.3	23.3			21.3	23.3
5	21.0	24.5	[illegible]	21.0	25.2	21.0	28.0	25.2	24.5	24.5	20.3	20.6	23.2
6		26.7	27.9	28.8	[illegible]	23.3	30.0	25.6	24.7	26.7		30.4	27.7
7	30.8	28.0	22.3	25.5	28.0	23.8	30.0	22.3	21.0		26.7	21.3	24.8
8	24.5	24.5	21.4	21.0	25.6	24.5	28.0	22.4	24.5			22.8	22.7
9	21.0		22.8	24.5	21.3	24.5	21.0	24.9	21.0	21.0		23.0	23.3
10	34.5		[illegible]	30.0	27.8	30.0	29.2	32.7	26.2	30.0		29.2	29.6
11	25.0	26.2	22.9	22.5	[illegible]	22.5	22.5	23.0	22.5	22.5		26.2	23.2
12	27.0	26.2	[illegible]	26.2	[illegible]	22.5	[illegible]	30.0	22.5	26.2	26.2	27.4	26.1
13	26.3	28.0	21.4	25.9	24.5	26.6	28.0	26.0	26.6	28.0		21.0	25.4
14	24.8		22.5	25.5	30.0	26.2	30.0	26.2	30.0	26.2		23.0	25.7
M	24.9	26.2	23.5	25.5	25.6	24.1	27.8	25.1	24.5	26.2	26.2	23.0	23.4
Group III													
1			26.7	27.1	22.7	26.4	26.7	28.7		26.7		29.3	27.1
2	26.7	28.0	26.7	26.0	26.7	26.7	25.3	26.7	26.7	28.0		25.3	26.4
3			22.5	26.2	23.2	23.2		28.5	22.4			21.8	23.6
4	26.7		26.7	28.5	28.0	28.0	28.7	28.7	28.7			28.0	27.8
5	24.0	23.3	26.7	27.3	20.0		24.7	26.7	26.7	23.3		26.8	25.2
6			23.3	24.3				26.7	26.7	23.3		26.7	25.3
7	26.7		26.7	26.7	24.7	26.7		25.3	26.7			26.7	26.2
8	23.3	26.7	24.6	26.7	25.3	26.7		23.3		26.7		26.7	25.3
9	26.7		23.3	24.3	[illegible]	26.7	26.7	26.7				26.7	25.1
10	25.6	28.0	28.0	28.2	28.0	28.3	26.7	24.9		28.0		26.7	27.1
11		20.0	24.9	28.0	20.0	23.3	28.0	28.0		6.7		23.8	23.1
12	26.7	26.7	26.7	26.7	26.7	26.7	26.7	26.7	26.7	26.7		26.7	26.7
13	24.7		23.5	23.3	23.3	23.3		24.7	23.3			23.7	23.7
M	26.7	26.7	26.7	26.7	24.0	26.7	26.7	26.7	26.7	26.7		26.7	26.7

NUMBER OF CLASS HOURS

Table 10 indicates the number of 60-minute hours spent weekly by teachers in class and assembly duties in these schools by departments and groups. The teachers of Group III schools work more periods and also more hours than in either Groups I or II. Teachers of Group I average .9 period less per week than in Group II, but their actual time in hours is 2.2 more, due to the somewhat longer class period in these schools. (In this report, the intermission between classes has been included in the recitation time because the majority of schools did not indicate the time in such a manner that the length of the intermission could be determined.) Twenty-five hours a week of regularly assigned school duties requiring instruction or supervised study groups seems to be the standard for these schools, and the average length of class period is 42 minutes. The median for the schools of Groups I and II is 24.8 hours a week. Bobbitt found a median of 23.2 hours, but his investigation is based on teaching time only, while this report includes study hall duty with recitation time.

NUMBER OF STUDENT HOURS

The teacher's total load is determined by two factors: first, the number of classes daily (the most important factor), and second, the number of pupils in all classes. By combining these two factors and stating the result in hours instead of class periods, we may say the teacher's load is determined by the number of student-hours a week which her work represents.

TABLE 11.—NUMBER OF STUDENT HOURS A WEEK PER TEACHER

Group and School	Commercial	Drawing and Art	English	History	Household Arts	Latin	Manual Arts	Mathematics	Modern Languages	Music	Physical Training	Science	Average
Group I													
1	539	264	673	522	313	535	288	618	513	864		393	514
2	366	296	555	470	252	296	289	541	415	1,791	502	475	434
3	320	212	612	582	432	509	443	536	489	260	346	579	508
4	390	308	567	531	335	313	538	680	444			440	470
5			414	700	323	395	375	627	531			385	456
6	645	192	692	595	490	402	260	609	652	691	1,182	616	576
7	628	303	358	466	318	385	392	436	487	1,248	1,061	476	465
M	465	280	567	531	323	395	375	609	489	864	732	475	470
Group II													
1	542		301	392	450	321	194	507	415	1,758		491	471
2	730	250	682	629	357	610	525	523	381	2,110		299	592
3	815		521	748	645	453	315	553	407			457	538
4		242	420	793	429	423	470	473	513	982		379	472
5	592	298	423	535	496	433	784	515	264	1,061	292	396	466
6		216	732	619	533	465	524	806	560	2,320		647	641
7	753	760	485	592	685	492	679	510	416		778	329	531
8	441	245	460	567	264	451	504	506	335			455	438
9	301		492	544	331	352	302	508	573	1,010		347	435
10	690		464	565	308	493	468	507	308	1,144		409	485
11	531	420	400	457	348	409	373	572	439	492		328	429
12	689	238	502	629	168	507	245	672	450	413	420	589	526
13	409	980	480	658	329	443	430	526	431	1,488		496	489
14	611		581	557	210	416	254	480	555	1,379		435	499
M	601	250	489	580	352	447	449	511	423	1,144	420	422	487
Group III													
1			525	529	293	396	417	439		2,333		462	470
2	344	705	498	549	475	545	448	474	600	705		335	497
3			555	623	442	256		618	398			332	457
4	336		300	387	181	308	492	402				209	313
5	392	372	568	602	240		252	560	80	875		324	405
6			303	175				325	352	846		240	323
7	144		320	330	333	269		217	316			176	248
8	187	213	334	293	508	213		334		480		355	318
9	160		170	105	280	188	212	195				104	179
10	639	255	706	850	301	572	293	565		1,575		442	608
11		300	143	240	160	136	213	136		125		214	160
12	305	1,333	500	453	212	124	160	551	355	1,706		533	444
13	170		449	620	161	340		483	338			381	407
M	305	336	449	453	286	269	272	439	352	860		332	405

Table 11 shows this factor for each school, group, and subject. Reference to the right-hand total column shows that 480 is about the standard for schools of Groups I and II, and 405 for Group III. The variations between subjects within any school are far more marked than are variations between school totals. Here again, with the exception of music, the subjects that require the least work in preparation and correction seem to be the ones to escape with the lightest load.

Number of Different Subjects Taught by Teachers

Another important factor in the teacher's load is the number of different subjects which he or she is called upon to teach. The fewer the number of subjects and the more closely related they are, the less will be the daily work of the teacher in preparation

TABLE 12.—NUMBER AND PER CENT OF TEACHERS WHO TEACH ONE TWO, THREE, OR FOUR OR MORE DIFFERENT SUBJECTS

GROUP AND SCHOOL	Number teachers teaching 1 subject	Number teachers teaching 2 subjects	Number teachers teaching 3 subjects	Number teachers teaching 4 or more subjects	All	Per cent of teachers teaching 1 subject	Per cent of teachers teaching 2 subjects	Per cent of teachers teaching 3 subjects	Per cent of teachers teaching 4 or more subjects
Group I									
1....	29				29	100	...		....
2	21	4			25	84	16		....
3....	20	5			25	80	20		...
4....	18	3			21	86	14	.	....
5	18	1			19	95	5		....
6	30	3			33	91	9		....
7....	48	5			53	94	6		....
Totals..	184	19			203	91	9		....
Group II									
1....	20	2			22	91	9	..	......
2....	9	3	1		13	69	23	8	.....
3	11	4	.		15	73	27		....
4....	5	3	..		8	63	37		..
5....	9	5			14	64	36		..
6	2	6	1		9	22	67	11	..
7....	12	5	1		18	67	28	5	.
8....	7	2	2	1	12	58	17	17	8
9....	5	4	1	...	10	50	40	10	.....
10....	6	3	1		10	60	30	10	......
11	12	2			14	86	14	..	......
12....	10	2	2	.....	14	72	14	14	....
13....	6	5			11	55	45		..
14....	7	5			12	58	42		....
Totals..	121	51	9	1	182	66	28	5	1
Group III									
1....	4	3	3		10	40	30	30	......
2....	3	1	2		6	50	17	33	.....
3....	5	3			8	63	37	....	....
4....			2	1	3	.	...	67	33
5....	1	3	1		5	20	60	20	..
6		2	1	.	3		67	33	....
7....		1	2	1	4	....	25	50	25
8..	1	2	2		5	20	40	40	.....
9...			3	.	3	...	......	100	......
10....	.	3	3	.	6	...	50	50	......
11....	1	1	.	2	4	25	25	......	50
12	1	2	3	.....	6	17	33	50	.....
13...	2	4	....	......	6	33	67	......	......
Totals..	18	25	22	4	69	26	36	32	6

Table 12 shows the facts relative to the number of subjects taught by teachers in the schools covered by this study. The table, however, does not tell the whole story, for a teacher might be credited as teaching science (one subject), but the schedule might show this teacher teaching two or three sciences having but little in common. This latter condition applies more to the smaller schools than to the larger, and if taken into account would tend to increase the number of schools in that group showing a large per cent of teachers having four or more subjects.

This table shows clearly that the number of subjects per teacher increases as we proceed from the larger to the smaller schools. Ninety-one per cent of teachers in Group I teach but one subject; 66 per cent in Group II; and but 26 per cent in Group III. No teachers in Group I teach more than two subjects; 6 per cent in Group II; and 38 per cent in Group III.

TABLE 13.—AVERAGE NUMBER OF PUPIL ENROLLMENTS PER TEACHER

School	GROUP I			GROUP II			GROUP III		
	Academic	Special	Total	Academic	Special	Total	Academic	Special	Total
1	152	108	142	181	202	188	185	302	209
2	141	58	115	147	286	187	88	134	94
3	157	65	135	134	163	138	148	423	211
4	107	139	119	138	108	130	84	423	105
5	121	120	121	124	57	111	125	153	136
6	114	157	128	133	223	152	130	204	150
7	92	67	82	139	146	141	128	49	120
8				133	77	117	131	150	136
9				138	230	158	122	65	115
10				145	114	138	74	43	68
11				112	139	119	98	85	95
12				112	87	110	50	87	63
13				118	141	124	47	39	45
14				112	136	118			
Med.	121	108	121	133	140	134	122	134	115

*Study hall enrollment is not included in this table.

NUMBER OF PUPILS INSTRUCTED

Table 13 shows the average number of pupil enrollments in the classes of each teacher in each school and group. The tabulation omits individual subjects and gives the results for those subjects when grouped together as academic (English, history, Latin, mathematics, modern language, science) and special subjects (commercial, drawing, household arts, manual arts, music, and physical training). If music were omitted the number in the special subject column would be much reduced. Another reason for the higher number under "special" is that many of these classes meet but one or two periods a week. This increases the number of enrollments for these teachers if they teach approximately the same number of periods weekly as teachers of academic subjects. The numbers indicated in Table 13 are from 10 to 50 per cent greater than those reported by Monroe for Kansas schools.

COMPARISON OF STUDY HALL AND INSTRUCTIONAL COSTS

As indicated previously in this report, study hall cost has been included in instructional costs. As several schools did not report the number of pupils in their various assembly study periods, the study hall cost per 100 pupil-hours could not be computed.

TABLE 14.—PER CENT THE STUDY HALL COST IS OF INSTRUCTIONAL COST AND AVERAGE SIZE OF STUDY HALL GROUPS*

School	GROUP I		GROUP II		GROUP III	
	Per cent cost	Average size of class groups	Per cent cost	Average size of class groups	Per cent cost	Average size of class groups
1	4† (45)	60† (16.0)	16	66	21	X
2	20	38	14	91	24	47
3	20	50	10	113	22	77
4	9	167	17	74	29	30
5	16	56	12	132	14	44
6	40	18.2†	23	79		
7	7	120	10	135		
8			16	91		
9			16	X	29	X
10			15	85	27	58
11			10	71		
12			12	61	8	42
13			20	61	23	X
14			13	91		
Median	20	50	14.5	85	21	45.5

*Class groups marked (x) were reported without indication of size.
†Supervised study. Approximate results.

Table 14 and Figure 7 show the per cent the study hall cost is of the actual instructional cost, and the average size of the study hall groups so far as reports were complete. The study cost percentage increases in no marked degree from the larger to the smaller schools, being 20, 14.5, and 21, respectively, for the schools of Groups I, II, and III. There are also great variations within the schools of any one group. For example, the schools of Group II show a variation from 10 to 23 per cent and in Group III from 0 to 29 per cent. Several schools of Group III report no assembly study groups. As the normal pupil carries 4 subjects daily, and as the usual program has 7 or 8 daily periods, it is improbable that any school is without study groups. However, in some of these schools these study groups sit in rooms where classes are reciting, and hence the teacher's weekly schedule as reported to me credits the teacher with a recitation class and not with a study group. Two schools of Group I, one having no assembly cost and the other having but 4 per cent, are operating on a supervised study basis and the time has been charged directly to instructional cost. With a proper division of time between study and recitation these figures should be 40 per cent and 45 per cent, respectively.

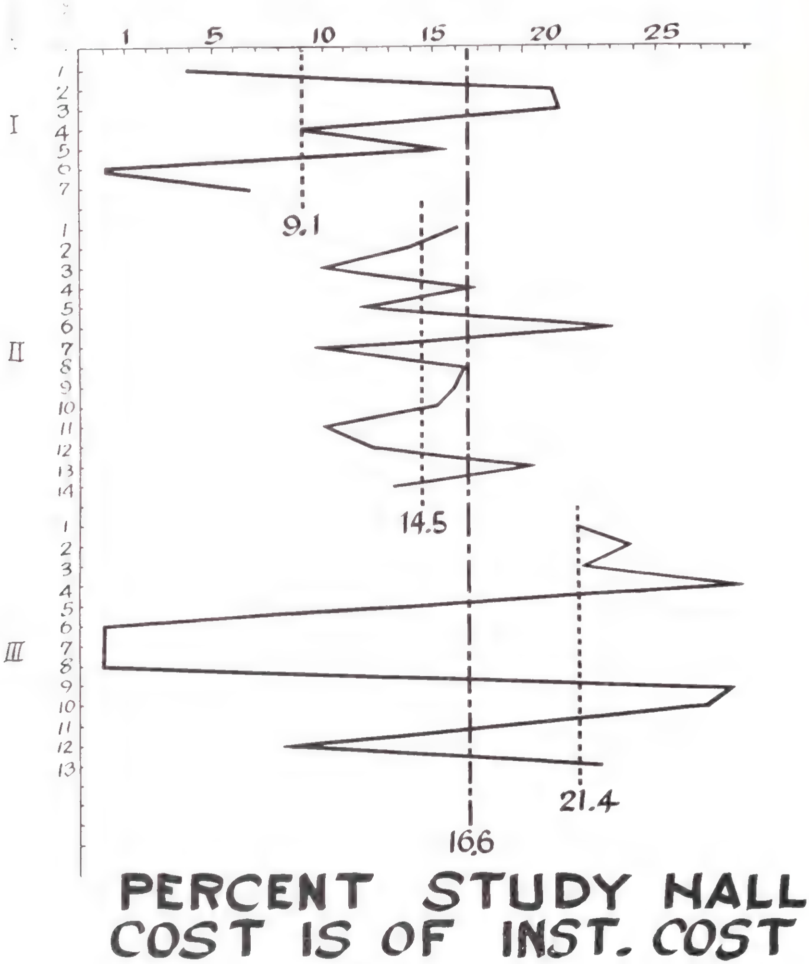

FIG. VII.

The problem of better direction of study is receiving much attention among high school administrators. The plan generally in vogue at the present time of large assembly groups under the direction of one teacher, who is present for the maintenance of order, has not yielded satisfactory results. The plan of doubling the time of the usual class periods, using one-half for recitation and the other one-half for supervised study, has not been employed extensively because of its prohibitive cost.

Table 14 indicates that present practice favors study groups of from 55 to 60 pupils each in schools of Group I, but with a range of variation from 16 to 167. Schools of Group II favor a median study group of 85 pupils with a variation from 61 to 135. Group III has a median of 45 with a variation from 30 to 77. Only the most successful teachers are able to keep 50 or 60 pupils at effective study; and in large groups including the preparation of many subjects, it is apparent that no one teacher can give any effective supervision to study hall work.

In my judgment, where study hall cost approximates 20 per cent of the instructional cost, a school would do well to seriously consider introducing some plan of effectively directed study. Instead of 40-minute periods for recitation only, 60-minute periods could be substituted for combined recitation and study, and the class groups could be increased somewhat in size over the present standards in most of the schools of Groups I and II. Under the present plan of work, teachers in Groups I and II average 6 recitation periods a day, and have in addition one period daily assigned to study hall and another to conferences with pupils, or a total of eight periods or about 6 hours a day. Under the proposed plan each teacher would have not to exceed 6 1-hour periods daily with assembly and conference periods eliminated. With a 20 per cent increase in class size the number of daily classes could be decreased to 5 with the present teaching force. It seems possible by proper administrative readjustments to increase the effectiveness of school study by careful direction without increasing the burden upon the teacher or increasing the burden of cost to the taxpayers. The high school at Richmond, Ind., has been operating on a 65-minute basis during the present year without any increase in cost. The instructional and study cost for this school is exactly the median for schools of Group I, as may be seen by consulting Table 1 or Figure 3.

It may be found on trial that carefully supervised study during the ninth and tenth years will be sufficient to develop good and lasting study habits, and that in the eleventh and twelfth years pupils may do satisfactory work in large assembly study groups as at present. The Joliet (Ill.) township high school operates on this basis.

THE PROGRAM OF STUDIES

The ordinary school program shows merely what subjects are offered and gives no indication of the number of credits attempted in each subject, which is the value attached to these subjects by the pupil or community.

TABLE 15. PER CENT THE NUMBER OF CREDITS IN EACH DEPARTMENT IS OF THE WHOLE NUMBER OF CREDITS ATTEMPTED

Group and School	Commerce	Drawing and Art	English	History	Household Arts	Latin	Manual Arts	Mathematics	Modern Languages	Music	Physical Training	Science
Group I												
1.	16.3	1.7	25.5	7.6	4.3	6.5	6.1	15.1	7.8	1.8	0	7.2
2....	7.7	1.8	22.4	7.8	2.5	6.4	2.4	18.6	13.1	1.1	2.4	13.7
	2.1	.8	23.7	12.3	3.7	12.9	4.1	19.7	9.4	1.3	1.2	8.7
4....	7.8	2.0	25.6	8.9	4.1	6.1	3.5	19.8	13.7	0*	0	10.4
5....	0	0	21.7	18.4	4.7	9.3	6.2	16.6	11.7	0	0	11.4
6....	14.7	.9	19.7	6.8	5.6	4.1	5.2	16.0	11.9	2.3	4.7	8.1
7....	11.5	1.9	22.8	10.8	2.8	5.3	2.9	16.8	8.4	1.1	6.3	9.4
M	7.7	1.7	22.8	8.9	4.1	6.4	4.1	16.8	11.7	1.1	1.2	9.4
Group II												
1	16.1	0	23.5	7.0	2.3	7.9	.8	19.5	13.9	2.8	0	6.2
2....	11.1	.3	26.0	12.1	2.8	7.8	3.6	21.4	5.0	3.6	0	6.4
3....	11.0	0	24.1	12.8	4.8	11.6	3.5	19.9	5.2	0	0	7.1
4....	0	.1	24.0	13.8	5.5	12.2	4.3	19.2	6.0	3.0	0	11.9
5....	9.1	.4	23.6	12.9	5.7	10.4	2.8	16.0	4.2	2.1	1.6	11.2
6....	0	.5	26.3	14.7	6.7	4.4	3.9	17.6	10.1	1.9	0	14.3
7....	7.0	.8	26.1	11.5	6.1	13.6	4.2	18.2	6.2	0	3.6	6.7
8....	2.2	.6	23.7	16.5	3.7	11.1	2.2	19.3	10.0	0	0	10.6
9....	3.6	0	23.3	11.9	3.9	7.7	4.5	21.8	12.5	1.5	0	9.3
10....	14.9	0	23.7	11.9	5.5	10.4	4.0	15.6	5.9	2.4	0	5.7
11....	12.9	3.2	14.4	15.9	2.8	7.5	2.4	18.5	9.6	1.8	0	11.7
12....	19.4	.9	22.7	11.3	1.2	4.2	3.6	10.6	7.6	1.0	.8	16.8
13....	2.9	.5	22.7	11.9	4.4	14.0	4.6	18.8	9.1	2.4	0	8.5
14....	5.0	0	25.3	12.8	1.4	10.8	1.6	19.8	10.9	1.9	0	9.9
M.......	7.3	.5	23.7	12.5	4.1	10.4	3.6	19.0	8.3	1.9	0	9.6
Group III												
1....	0	0	25.4	10.6	5.3	10.1	6.3	14.4	0	4.8	0	23.1
2....	5.0	2.3	22.7	15.0	4.9	9.5	1.6	16.4	10.4	4.7	0	9.5
3....	0	0	24.6	15.8	6.3	7.3	0	18.3	15.2	0	0	12.5
4....	6.3	0	23.7	19.3	3.8	16.0	2.5	20.3	0	0	0	7.7
5....	7.7	2.3	30.8	21.2	5.8	0	2.4	10.1	1.5	7.0	0	11.2
6....	0	0	22.0	12.4	0	0	0	20.9	22.6	6.8	0	15.3
7....	3.4	0	21.6	14.9	8.1	18.2	0	15.5	14.2	0	0	4.1
8....	3.3	.7	28.3	9.2	8.3	13.3	0	17.9	0	1.5	0	17.5
9....	5.9	0	21.8	12.9	11.8	13.9	7.9	21.8	0	0	0	4.0
10....	8.8	.8	22.3	15.9	1.1	17.9	1.2	16.1	0	4.5	0	11.9
11....	0	3.7	28.5	11.1	2.9	12.4	5.9	12.4	0	9.4	0	13.8
12....	4.8	1.5	22.8	15.5	2.4	4.2	1.9	18.8	12.1	3.9	0	12.1
13....	1.4	0	29.7	15.5	1.4	8.5	0	19.0	11.3	0	0	13.2
M.......	3.3	0	23.7	15.0	4.9	10.1	1.6	17.9	1.5	3.9	0	12.1

*School 4 of Group I reported music after all the tables had been computed.

As a by-product of the study of costs, the percentage composition of the program of study has been computed, based on the number of credits attempted in each department. Table 15 and Figure VIII show the results by schools, groups, and subjects. With the exception of school 4 of Group I, which made a supplementary report on music too late to include in this study, the data of this table are as reported by the schools. It may be that some chorus work reported is given without credit but has been here tabulated as .1 credit for every full time pupil recitation per week.

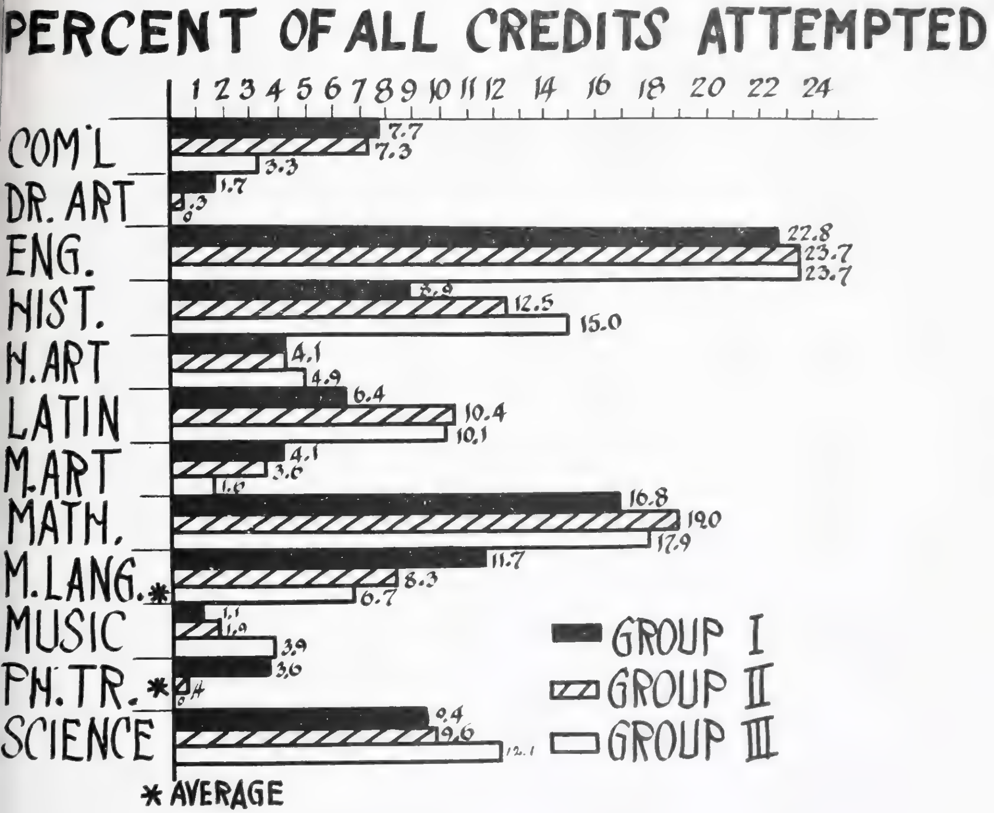

FIG. VIII.

From the table certain facts stand out clearly: first, approximately four years of English is taken if not required (23.7 per cent of the total credits); second, physical training, which is of more value during the high school age than at any other period of life, is a negligible quantity, having a percentage of 0 for the median in Groups II and III and but 1.2 in Group I; third, that drawing and art receive too little emphasis to realize either their cultural or vocational values; fourth, that the so-called pre-vocational subjects of household arts and manual arts have not yet usurped to any considerable degree the place of the traditional subjects. Latin seems to be giving way to modern language in the larger schools (Group I), but it has a distinct lead in the schools of Groups II and III. Owing to the peculiar conditions in school 5 of Group III (the median case in modern language) 6.7 (the average) should be substituted for 1.5 (the median) to represent adequately the work attempted in this subject. The group medians for commercial work probably represent a reasonable demand upon the high school program, but it may be seriously questioned whether a 15 to 20 per cent allotment of credits to this subject as reported from several schools is in all cases a proper demand. Even the industrial centers need no such proportion of workers trained along these lines. As a result, we are making these commercial courses a preparation for the blindest of blind alley jobs, and are being treated to the spectacle of graduates of our high school commercial courses competing for $4 a week positions. A considerable taking of certain commercial subjects as electives by students who do not expect to enter commercial employment may be justified because of the general utility of these subjects to the average man.

The small number of failures in all the special and vocational subjects in most schools gives rise to a suspicion, sometimes openly expressed, that the popularity of these courses is due to the ease with which students may earn their credits rather than to their recognized social values.

When the importance of the social and natural sciences for modern life is considered, the attention they receive in Group I schools is perhaps too little. If need be the English and foreign language departments could still afford to suffer a slight diminution of their glory in favor of these subjects which have as great cultural and disciplinary values, and greater social and practical values than the foreign languages.

While the group medians represent fairly well-balanced programs, many individual schools have a very faulty organization as judged by these median standards. This, in part, cannot be avoided in the smaller schools where only a limited number of subjects can be offered effectively. However, even here some balance should be maintained. In the smaller schools one foreign language should be sufficient, but many are attempting two, thereby giving undue emphasis to the language work and at the same time producing a high cost for instruction by operating a large number of small classes. In schools of Group III science, including agriculture, might well receive 15 or 20 per cent of the credits attempted.

As further examples of lack of balance in the program, several illustrations will follow. School 7 of Group III shows 33 per cent of its credits in foreign languages and but 4 per cent in science. School 5 of this group shows about 50 per cent more credits in English and history than its group standard and double the standard in music, but is giving language instruction to but 3 pupils, which represents 1.5 per cent of all the credits attempted by the school. School 6 of this group offers no work in one-half the subjects as classified in this report, and perhaps wisely so, but it is doubtful whether so much stress should be given to foreign language and music rather than to history and household arts. As this school is below the group median in costs, it might well afford to extend its offerings somewhat in departments of work not now offered. School 5 of Group I reported no offerings in commercial, drawing and art, music, or physical training. Coöperative arrangement with local commercial colleges might remove the need for offering the commercial courses in the high school, but in a school of this size all these departments should be represented on the high school program. The natural science column shows great variability in all three groups, which indicates a marked lack of standardization for a subject which has so long had a place on the high school program.

On page 25 of his report on costs in Kansas high schools, Monroe indicates the per cent of teaching time devoted to each subject of the program. This is desirable from the point of view of costs, but it affords no index of the actual credit values offered by subjects, which is the information desired by the administrator in reorganizing his program of studies. The medians of Table 15 indicate standards of curriculum organization in Indiana so far as we may be said to have developed any standards. Fig. VIII represents graphically these median standards.

At the end of the first semester supplementary forms were sent out to ascertain the number of credits attempted in each subject, the number passed, and the number failed, so that costs might be also computed on the basis of the number of credits passed, and standards determined for failure in the different subjects. As less than one-half the schools made this report, it has been impossible to treat adequately this phase of the investigation.

This investigation has been undertaken not to disseminate any predetermined opinions relative to high school costs and organization, but has been entered into coöperatively by the 34 schools for the purpose of gathering essential facts concerning high school costs and organization that each school administrator might have comparative data by which to check and guide his own practice.

The Measurement of Achievement in Algebra

Hubert G. Childs

In April, 1915, the research committee of the Indiana High School Principals' Association in conference with the writer decided to recommend a coöperative study in testing achievement in algebra. The writer assumed responsibility for the arrangement of the tests and the tabulation of data. Acknowledgements are due to Mr. J. Z. A. McCaughan of the Bloomington high school for assistance in the selection of the tests and determination of their preliminary arrangement.

A series of twelve tests was arranged, based largely on the Monroe tests which had been used in the schools of Kansas during the year. The Monroe tests were added to by the inclusion of tests in formal subtraction of polynomials (Test I), long division (Test IV), easy and difficult problems to be stated in the form of equations (Tests VII and XII), factoring (Test X), and solving simultaneous linear equations (Test XI). Test B of the Monroe series was slightly modified, and calls for the clearing of fractional equations of fractions (Test VIII). The following samples indicate the type of problems used in each of the tests. Where the problems of any test were recognized to be of unequal difficulty, the more difficult forms were introduced at regular intervals so as to have the results comparable whether a pupil completed 3 or 4 or 10 or 12 exercises in a given test.

Test I. Subtract. Time, 2 minutes.

$$\begin{array}{rrr} 10a & -\ 17b & +\ 240 \\ -3a & +\ \ 2b & -\ 100 \\ \hline \end{array}$$

Test II. Multiply and remove parenthesis. Time, 1 minute.

$\pm 4\ (\pm 3x \pm 7)$

Test III. Solve for x. Time, 1 minute.

$\pm 15x = \pm 4.$

Test IV. Divide. Time, 6 minutes.

$$\underline{3x - 2}\,\big|\overline{-3x^2 + 17x - 10}$$

Test V. Transpose terms. Time, 1 minute.

$-4x + 5 = 3x - 9$

Test VI. Collect terms. Time, 2 minutes.

$-53x + 10 + 115 + 10x$

Test VII. State as an equation. Time, 4 minutes.

The sum of two numbers is 160. The greater is four times the less. Find each number.

Test VIII. Clear of fractions. Time, 3 minutes.

$$\frac{7x - 2}{6} + \frac{x + 1}{8} = x$$

Test IX. Solve for x. Time, 10 minutes.

$$\frac{3x + 2}{4} = \frac{x + 2}{6}$$

Test X. Factor. Time, 2 minutes.

$x^2 + 2x - 24$ (five type forms given).

Test XI. Solve for both unknowns. Time, 5 minutes.

$7x - 4y = 12$
$8x - 5y = 0$

Test XII. State as an equation. Time, 10 minutes.

The tens' digit of a number, expressed by two digits, is three times the units' digit. If the number, diminished by 33, is divided by the difference of the digits, the quotient is 10. What is the number?

In many respects these tests lack many of the characteristics of highly scientific tests. For example, the relative values of the different types of processes have not been determined, nor are all the examples under any one test of equal difficulty, nor do the examples under any one test form a graded series of steps of known difference of difficulty. All these defects are also apparent in the tests of Thorndike, Monroe, and Rugg. However, these tests have accomplished in part the immediate purpose of the coöperators, namely, the determination of a norm of achievement of certain types in first year algebra in Indiana high schools, within the limits of the tests and the small number of schools coöperating.

A uniform set of directions was sent out to each school giving the tests, and the tests were given in the several schools within two weeks of the completion of the term's work. The results show the usual wide range of variation between schools and between pupils of the same school and class.

Some teachers may object that these tests do not represent a fair measure of the algebraic ability of the pupils of a given school, since not all the processes tested are deemed of equal worth by all teachers and hence have not received equal emphasis and drill, while others more emphasized by some have been omitted. This objection is true in part, but such processes as are represented by Tests II, III, V, VI, VII, IX, and X are generally considered important and should receive such emphasis as to render these processes automatic and accurate at the hands of the pupils.

One objection to the tests as arranged is that the time required for their administration is too long. From this point of view the number of tests should be reduced to 7 or 8 thru the elimination of some and the combination of others. All possible processes cannot be tested in a general comparative test, but only a few of the most characteristic. In the interest of time economy the writer recommends the use of the following tests only for those schools wishing to compare their algebraic achievement with the norms indicated in this study: Tests II, III, V, VI, VII, IX, and X. These tests can be administered within the time limits of the usual classroom period of 40 minutes.

Ten schools, including 435 pupils, contributed to the results for the first semester's work in algebra and 5 of these with 5 others, 367 pupils, contributed the data showing the achievement at the completion of a full year's work. Several other schools have given the tests but they have failed to contribute their data to this coöperative study.

The writer has thought it best to reduce the results for each test to terms of achievement (attempts and rights) per minute as affording a better basis for the comparison of test with test and for summarizing the average achievement in several tests combined.

TABLE I. ACHIEVEMENT IN FIRST SEMESTER ALGEBRA

Stated in terms of achievement per minute

No. of School	Test I				Test II				Test III			
	Attempts	Rights	Accuracy	Coefficient	Attempts	Rights	Accuracy	Coefficient	Attempts	Rights	Accuracy	Coefficient
1	3.35	.75	22	17−	6.50	5.00	77	385	6.90	3.00	43	129
2	3.85	2.75	72	198	7.60	6.90	91	628	8.60	6.70	78	523
3	4.05	1.65	41	68−	7.60	6.50	86	559	7.80	3.10	46	124
4	2.65	.65	18	12−	8.30	7.60	92	699	5.60	2.60	46	120
5	2.30	.70	30	21	8.60	5.00	58	290	6.50	1.50	23	35
8	3.55	1.55	44	68	7.30	5.90	81	478	6.90	3.30	48	158
9	4.30	2.70	63	170	8.10	7.20	88	634	9.10	8.20	90	738
10	3.20	1.50	47	71−	7.60	7.20	93	660	9.40	8.30	88	730
13	4.20	1.30	31	41−	7.90	6.70	85	570	6.50	3.30	51	168
15	3.90	2.75	71	196	7.50	6.30	84	529	7.00	4.00	57	228
Median		1.52	46	70		6.60	86	565		3.30	50	163
High		2.75	72	198		7.60	92	699		8.20	90	738
Low		.65	18	12−		5.00	58	290		1.50	23	35
Ratio High to Low				17−1				2½−1				21−1

Number of School	Test IV				Test V				Test VI			
	Attempts	Rights	Accuracy	Coefficient	Attempts	Rights	Accuracy	Coefficient	Attempts	Rights	Accuracy	Coefficient
1	.88	.29	26	6	4.70	3.50	74	259	2.95	1.95	49	71
2	.80	.38	48	18+	4.80	3.60	83	299	3.40	2.40	71	171−
3	.88	.40	45	18	5.90	4.70	80	376	3.20	2.05	65	134−
4	1.38	.45	33	16	5.40	4.80	89	429	3.75	2.65	71	188
5	1.12	.20	18	4−	4.50	1.30	29	38	3.00	1.60	53	85
8	.82	.35	43	15	4.70	4.30	92	396	3.90	1.90	49	93
9	.87	.48	56	27	6.20	5.90	95	561	4.20	3.40	81	276−
10	.67	.38	58	22+	5.00	4.60	92	423	3.45	2.85	83	237−
13	.75	.45	60	27	5.20	4.40	85	374	3.05	2.00	66	132
15	.90	.42	47	20−	4.30	2.50	58	145	4.00	3.00	75	225
Medians		.39	47	18		4.50	83	375		2.22	68	152
High		.45	60	27		4.80	89	429		3.40	81	276
Low		.20	18	4−		1.30	29	38		1.95	49	71
Ratio of High to Low				7−1				11−1				4−1

Number of School	Test VII				Test VIII				Test IX			
	Attempts	Rights	Accuracy	Coefficient	Attempts	Rights	Accuracy	Coefficient	Attempts	Rights	Accuracy	Coefficient
1	1.65	1.10	67	74−	...	...			...			
2	1.52	1.20	79	95−	1.27	0	0	0				
3	1.35	.60	44	27−	1.60	.43	27	12−	.56	.16	29	5−
4	1.62	1.15	71	82	2.26	.83	37	31	.88	.26	31	8
5	1.30	.82	63	52	.43	0	0	0	.15	0	0	0
8	1.62	1.05	65	68+	.43	.20	14	3−	.53	.08	15	1+
9	1.69	1.12	67	76−	1.87	.53	29	15+	.73	.18	25	4½
10	1.55	1.32	86	114	...	...		...				
13	1.22	.80	65	52	...	...	...	...	...		...	...
15	1.50	1.12	75	85−	1.57	.20	13	3−	.45	.09	20	2−
Medians	.	1.10	67	75−	...	.20	14	3−	.	.14	22	3+
High	..	1.32	86	114	..	.83	37	31		.26	31	8
Low	.	.60	44	27−	.	0	0	0		0	0	0
Ratio High to Low	....	......	..	3−1		...		X				X

Number of School	Test X				Average of First Seven Tests				Rank First† Seven
	Attempts	Rights	Accuracy	Coefficient	Attempts	Rights	Accuracy	Coefficient	
1	2.00	1.40	70	98	3.85	2.22	58	128	9, −
*2	2.80	2.00	71	142	4.29	3.42	80	272	3, +
3	2.90	1.50	52	78	.70	2.71	58	157	8, Av.
4	2.85	1.90	67	128−	4.24	2.84	67	190	5, Av.
5	1.65	.85	51	44	3.90	1.59	41	65	10, −
8	1.10	.40	36	15−	4.11	2.62	64	167	7, Av.
9	2.90	2.10	73	154−	4.92	4.14	84	348	1, +
10	2.20	1.90	86	164−	4.41	3.73	85	317	2, +
13	2.25	1.60	71	114−	3.95	2.71	69	186	6, Av.
15	2.70	1.75	65	114	4.16	2.87	69	198	4, Av.
Medians	.	1.68	68	114		2.77	68	188	
High		1.90	86	164		4.14	84	348	
Low		.40	36	15−		1.59	41	65	
Ratio of High to Low				11−1	.			5−1	

*Data incomplete for Test X. Estimate based on relative achievement in the first seven tests.

†"+", "Av.", "−", mean decidedly above average, average, decidedly below average, respectively.

TABLE 2. ACHIEVEMENT IN FIRST YEAR ALGEBRA

Stated in terms of achievement per minute

Number of School	Test I				Test II				Test III			
	Attempts	Rights	Accuracy	Coefficient	Attempts	Rights	Accuracy	Coefficient	Attempts	Rights	Accuracy	Coefficient
2	4.05	2.50	62	155	8.60	7.60	89	676	10.7	10.3	96	989
4	4.05	2.25	56	126	9.10	6.80	74	503	9.50	5.50	58	319
6	3.60	1.40	39	55	7.10	7.00	98	686	8.80	5.40	62	335
7	3.50	1.75	50	88	5.40	4.30	79	340	5.10	.90	17	15
8	3.85	.75	20	15	8.20	7.40	90	666	10.7	6.20	58	360
11	3.25	1.60	49	79	6.70	6.30	92	580	6.30	1.50	24	36
†12	3.60	1.20	33	40	6.30	4.80	76	365	9.00	6.00	67	402
13	3.50	1.15	33	38	8.90	7.90	89	703	10.3	6.50	63	410
14	3.35	1.60	48	77	7.50	7.10	95	675	8.20	6.10	74	451
15	3.90	2.40	62	149	7.80	7.20	92	662	11.1	10.3	93	958
Medians		1.60	49	79		7.30	91	664		6.10	63	384
High		2.50	62	155		7.90	89	703		10.3	96	989
Low		.75	20	15		4.30	79	340		.90	17	15
Ratio of High to Low				10—1				2—1				66—1

Number of School	Test IV				Test V				Test VI			
	Attempts	Rights	Accuracy	Coefficient	Attempts	Rights	Accuracy	Coefficient	Attempts	Rights	Accuracy	Coefficient
2	.93	.55	59	33	6.10	5.20	84	437	4.25	3.35	79	159
4	1.22	.32	26	8	5.90	4.70	80	376	4.25	2.60	61	265
6	.80	.38	48	18	5.10	4.30	84	361	3.75	2.60	69	180
7	.68	.38	56	22—	4.90	4.10	84	344	3.40	2.10	62	130
8	.93	.47	50	23+	6.20	5.80	94	513	3.80	2.60	68	177
11	.80	.55	69	38	4.30	3.70	86	318	3.00	2.30	77	177
12	.60	.30	50	15	4.40	3.40	77	262	2.85	1.75	61	107
13	.82	.40	49	20—	5.50	5.0	91	455	3.90	2.90	74	215
14	.80	.42	52	22	5.20	4.90	94	461	4.20	3.65	87	318
15	.88	.47	53	25—	5.80	4.40	76	334	3.65	3.05	83	253
Medians		.42	52	22—		4.50	82	368		2.60	69	178
High		.55	69	38		5.80	94	513		3.65	87	318
Low		.32	26	8		3.40	77	262		1.75	61	107
Ratio of High to Low				5—1				2—1				3—1

Number of School	Test VII				Test VIII				Test IX			
	Attempts	Rights	Accuracy	Coefficient	Attempts	Rights	Accuracy	Coefficient	Attempts	Rights	Accuracy	Coefficient
2	1.45	1.08	74	80	2.17	1.17	54	63	.70	.38	55	21
4	2.02	1.40	69	97	2.93	.93	31	29	.88	.35	40	14
6	1.50	1.08	71	76	1.83	.93	50	47	.68	.23	33	8−
7	1.62	.89	54	47	1.83	.30	16	5−	.62	.15	24	4−
8	1.68	1.38	82	113	1.63	.73	45	33	.59	.24	41	10−
11	1.40	.62	45	28								
12	1.58	.88	56	49	.77	.20	26	5+	.46	.13	27	3½
13	1.52	.92	61	57−	1.57	.77	49	38−	.43	.22	51	11+
14	1.82	1.35	74	100	1.73	.63	37	23	.70	.26	37	10−
15	1.60	1.18	73	86	1.97	.80	42	34	.78	.46	59	27
Medians		1.08	73	78		.73	45	33		.24	41	10−
High		1.38	82	113		1.17	54	63		.46	59	27
Low		.62	45	28		.30	16	5−		.13	27	3½
Ratio of High to Low				4−1				13−1				8−1

Number of School	Test X				Test XI				Test XII			
	Attempts	Rights	Accuracy	Coefficient	Attempts	Rights	Accuracy	Coefficient	Attempts	Rights	Accuracy	Coefficient
2	2.30	2.05	89	183	.84	.48	59	28	.40	.08	20	2−
4	3.75	2.05	55	113	1.26	.76	60	46−	.78	.21	27	6−
6	3.15	3.00	95	285								
7	2.90	2.40	82	197								
8	2.80	2.65	95	252	.92	.48	52	25	.61	.08	13	1
11												
12	1.45	.70	48	34−								
13	2.65	1.90	72	137	.88	.24	27	6+	.31	.08	26	2+
14	2.80	2.45	92	226								
15	3.10	2.75	89	245	.86	.46	53	24+	.39	.13	33	4+
Medians		2.40	82	197		.48	52	25		.08	26	2+
High		3.00	95	285		.76	60	46−		.21	27	6−
Low		.70	48	34−		.24	27	6+		.08	13	1
Ratio of High to Low				8−1				8−1				6−1

Number of School	Average All Tests				Average First Ten Tests				Average First Seven Tests				Rank First Seven Tests*
	Attempts	Rights	Accuracy	Coefficient	Attempts	Rights	Accuracy	Coefficient	Attempts	Rights	Accuracy	Coefficient	
2	3.54	2.89	81	235	4.12	3.42	83	283	5.15	4.37	85	371	1, +
4	3.80	2.32	61	142	4.36	2.69	62	166	5.15	3.38	66	223	7, Av.
6					3.63	2.63	72	190	4.38	3.16	72	227	6, Av.
7					3.00	1.73	58	100	3.51	2.06	59	121	10, —
8	3.49	2.40	69	165	4.04	2.82	70	196	5.05	3.51	70	245	5, Av.
11									3.68	2.37	65	154	9, —
12					3.10	1.94	63	122	4.05	2.62	65	170	8, —
13	3.36	2.33	69	161	3.91	2.77	71	197	4.92	3.54	72	255	4, Av.
14					3.63	2.85	78	222	4.44	3.59	81	290	3, +
15	3.49	2.79	80	223	4.06	3.29	81	267	4.96	4.13	83	343	2, +
Medians		2.40	69	165		2.82	70	196		3.33	71	236	
High		2.89	81	235		3.42	83	283		4.37	85	371	
Low		2.32	61	142		1.73	58	100		2.06	59	121	
Ratio of High to Low				2—1				3—1				3—1	

*"+", "Av.", and "—", mean decidedly above average, average, and decidedly below average respectively.

"†" means data incomplete for Test I. Estimate based on relative achievement in the other tests.

EXPLANATION AND INTERPRETATION OF THE TABLES

The 15 schools contributing to this study have each been designated by a number at the left under the heading "No. of School".

Table 1 should be read as follows: first term algebra pupils in school No. 13 averaged 4.2 examples attempted in Test I; 1.3 examples right; 31 per cent accuracy; and made an efficiency coefficient of 41, in an average time of 1 minute.

As the number of examples worked right in a given time combined with the per cent of accuracy determines the efficiency of the pupil or the school, the writer has taken the product of these two factors as a measure of efficiency of achievement thruout this study. While the writer is not sure that this index is the most reliable one, it has the value of giving weight to both the underlying factors, tho perhaps not in the most desirable proportions. It also affords a single term expression in which to compare individual or school achievement. Reference to the ratio of high to low records in the tables will carry conviction that this coefficient as a comparative measure has not done violence to the situation. For example, in Table 2 under Test II the high score of 7.9 right and 89 per cent accuracy is, no doubt, twice as efficient a record as the low score of 4.3 right and 74 per cent accuracy. Reference to Test III of the same table would seem to warrant the conclusion that if one school can secure a result of 10.3 rights and 96 per cent accuracy, the low score of .9 rights and 17 per cent accuracy is worth almost nothing and may reasonably be considered to be only 1-66 as efficient a piece of work.

Medians in these tables have been computed from these efficiency coefficients, and the medians for "rights" and "accuracy" are the "rights" and "accuracy" which accompany the median coefficient.

As measured by these coefficients the 10 schools tested in Table 2 have relative efficiencies varying from 2½ to 1 in Test II, to 21 to 1 in Test III, and with a ratio between high and low of 5 to 1 for the first 7 tests combined. The ratios of efficiency in Table 2 vary from 66 to 1 in Test III to 2 to 1 in Tests II and V, with a ratio of 3 to 1 for the first seven tests combined.

In fairness to some of the schools represented, it should be stated that because of the small number of pupils tested in some cases (but 10 in school No. 7) the results may be somewhat erratic and not fairly represent the quality of achievement ordinarily secured in these schools.

By comparing its efficiency coefficient for each test with the median, and by noting in how many tests it exceeds, is equal to, or below the median, any school can determine its approximate rating with respect to the others. The last column in each table shows the relative ratings of each of the schools for average achievement in the first 7 tests combined. An inspection of Table 1 shows that school 1 is below the median in 7 of the 8 tests taken and is about average in Test VII, while school 10 is above the median in every one of the 8 tests taken. The rankings of these 2 schools for the first 7 tests combined are ninth and second, respectively. School 13 is about average in 4 tests, is above average in 2, and below average in 2, or, on the whole, is about an average school in algebraic achievement.

The average achievement per minute for first semester pupils for the first 7 tests combined is rights 2.77, accuracy .68, and efficiency coefficient 188. For pupils at the end of the first year in algebra the corresponding figures are 3.33, .71, and 236 respectively. This represents a gain during the second half-year of about 26 per cent in the more fundamental processes taken up in the first term. The per cent of gain in the more difficult processes which receive chief emphasis during the second semester, however, is but slightly greater.

Tables 1 and 2 show vast differences in achievement in the various tests for the same time limit. This is, no doubt, due to two factors: first, relative difficulty or differences in the number of processes involved; and, second, the greater amount of drill given to certain types of processes which may vary in a marked degree with different teachers. As an example of such variation, Table 2 shows a median for Test II of 7.3 rights and .91 accuracy, while Test XII has a median of .08 rights and .26 accuracy for the same time. An inspection of the tests reveals the fact that Tests II, III, V, VI, and X represent simpler processes and forms that commonly receive much drill, while IV, VII, VIII, IX, XI, and XII represent a complexity of processes or reasoning ability in which the same degree of speed and accuracy may not be expected.

To answer the problem, to what extent the poor results of some of these schools are due to combining poor scores in unimportant, and hence unemphasized, processes with good results in the more important processes, certain comparisons between two schools of high achievement and two of low achievement are made for each of the first 7 tests from Table 2. Schools 2 and 15 are taken to represent high and 7 and 11 low achievement. An inspection of the table shows that school 2 scores very high in Tests I and III; above average in IV, V, and VI; and average in II and VII. School 15, very high in I, III, and VI; and average in II, IV, V, and VII. School 7 scores very low in II and III; below average in VI and VII; and average in I, IV, and V. School 11 scores very low in III and VII; below average in V; average in I, II, and VI; and very high in IV (one of the least important processes). With the exception of school 11 in one test it will be observed that the schools ranked high are average or high in all tests, while those ranked low are average or low in all. If we assume that the native algebraic ability of pupils in one school is probably equal to that of those in another, we must clearly attribute these differences in achievement to differences in the quality and effectiveness of the instruction in the different schools.

The value of measuring achievement thru coöperative standard tests should lie in making each teacher and school conscious of his or its shortcomings as revealed by comparison with others, and should lead to careful investigation to locate the source of weakness, and should further lead to such modification of subject-matter and method as will yield more efficient results. The standard test should be the best means of constructive supervision.

COMPARATIVE RESULTS IN OTHER STATES WITH SIMILAR TESTS

Comparative data are scarce. The tests given in Illinois last year by Mr. Rugg have Test I similar to Test II of this series, Test IV similar to our X, and VII to our IX. The following comparison shows the approximate achievements, the Indiana results being reduced to an average in place of the median to conform to Mr. Rugg's data:

NUMBER OF TEST	INDIANA		ILLINOIS	
	Rights	Accuracy	Rights	Accuracy
II	6.64	88%	6.36	77%
IX	27	42%	.23	31%
X	2.22	80%	1.19	53%

It will be noted that the most marked difference is in Test X, which deals with factoring. This difference may be due to some difference in difficulty of the two tests used, but a cursory inspection of the two reveals no marked differences of difficulty.

The Monroe tests have types equivalent to our II, III, V, VI, IX, and VIII. Mr. Monroe's results have been reduced to the median per minute basis in this comparison.

NUMBER OF TEST	INDIANA		KANSAS	
	Rights	Accuracy	Rights	Accuracy
II	7.3	91%	7.65	90%
III	6.1	63%	6.2	65%
V	4.5	82%	3.55	76%
VI	1.08	73%	2.33	67%
VIII	73	45%	.67	37%
IX	24	41%	.2	33%

The most marked difference in this comparison is in Test VI, collecting terms, which is clearly to our disadvantage. The Indiana results are somewhat superior in Tests V, VIII, and IX.

If the same tests were used and the same conditions observed in their administration, we should, no doubt, find the schools of different States securing approximately equal results in algebra or any other subject in which achievement should be measured, if a large number of schools be chosen.

MOST COMMON ERRORS OF PUPILS IN ALGEBRA

Professor Monroe and Mr. Rugg have carefully analyzed the typical errors made by pupils in the tests given by them, and the results of the two investigations are so much in agreement that it seems unnecessary to make a similar analysis for our test papers for we should, no doubt, find the same conditions.

The investigators, named above, have found errors in the use of signs, particularly the minus sign, to be the most prolific source of inaccuracy. This applies to all types of processes where the minus sign is used. The second most common source of error was inaccuracy in the fundamental processes of arithmetical computation; the third, mistakes in copying terms; the fourth, a closely related factor, the omission of terms, particularly x, the unknown, the value of which was to be found. Other conspicuous errors were the leaving of results in incompleted form, as $-x = 7$, and an inability to deal adequately with fractional forms.

LIMITATIONS OF THE INVESTIGATION IN ESTABLISHING COMPARATIVE NORMS OF ACHIEVEMENT IN ALGEBRA

The limitations of the types of tests used and the selection of exercises to make up each test have been referred to at the beginning of this article. There yet remains to be considered the reliability of the administration of the tests by each school and the accurate recording and tabulation of results.

The writer did not give the tests in person, but sent out uniform directions to be followed. Under the circumstances coaching for the test might have been possible had any teacher coöperating so desired. Personal acquaintance with the principals of the schools concerned and with many of the teachers, together with the results reported, give no ground for suspicion in this respect. It should also be stated that each school scored its own papers.

However, as a check, papers were called for from three schools and inspected. The per cent of errors found in scoring these papers was found to be very small, and of such a nature as to have no appreciable effect upon the tabulated returns which had previously been made. The writer is responsible for all comparative tabulations.

FURTHER INVESTIGATION

Further investigation is to be made to ascertain if there is agreement among algebra teachers as to what six or eight processes are most typical and significant for the first year work. Following this, two types of scales are contemplated: one containing several problems of equal difficulty under each test type, and to be given on the time limit basis (the present series of tests revised), the second to consist of a graded series of problems of three or four levels of difficulty under each test type and to be used chiefly for diagnostic purposes in analyzing the level of achievement of each pupil. This latter type of test has marked advantages as a basis for drill exercises in every important and minor process. Mr. Murray Dalman, of the Manual Training high school, Indianapolis, has done some good pioneer work in this respect.

In conclusion, the writer wishes to state that this investigation was undertaken to determine tentative norms only in certain types of algebraic achievement, and trusts that these results may be of some value both to the coöperators and to others who may care to make comparative tests. The achievement of the best schools is, perhaps, a better norm to work toward than the median results.

A Study of Enrollment, Acceleration, Retardation, and Normality in High Schools

Hubert G. Childs

During the year 1915 age-grade forms were sent to the members of the Indiana High School Principals' Association from whom nine replies were received. Separate forms were used for promoted, non-premoted, and withdrawn pupils to ascertain whether any significant differences would be apparent among these groups with respect to normality, acceleration, and retardation. The number of replies is too limited as a basis for standards, but the data as herein tabulated may be suggestive of possibilities of comparison.

The 4 cities listed under Group I range in population from 7,000 to 30,000, and the five in Group II from 500 to 4,000.

The data were taken from the school records of the first semester of the year, and the ages were recorded as for January 31. The normal age for the ninth grade was taken as 15 years, i.e. from 15 up to 16. The high school grade classification was determined as follows: ninth, 0 to 6 credits, inclusive; tenth, 7 to 14; eleventh, 15 to 22; twelfth, 23 to 31. Promotion, non-promotion, and withdrawal were determined by the status of the pupil at the close of the semester at promotion time.

TABLE 1.—PERCENTAGE ENROLLMENT OF HIGH SCHOOL PUPILS BY SEX AND GRADE

Group and School	GRADE AND SEX											
	IX			X			XI			XII		
	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	Total
Group I												
1	31.5	24.6	27.6	27.1	30.8	29.1	23.7	21.4	22.5	17.5	23.2	20.7
2	49.1	43.6	46.4	29.6	28.2	28.7	10.5	12.8	11.7	10.6	15.3	13.0
3	38.0	34.9	36.4	27.8	36.7	32.2	17.6	15.2	16.4	16.7	13.4	15.0
4	35.5	41.9	39.3	26.9	22.3	25.2	23.0	21.0	21.8	14.4	14.7	14.5
Group II												
1	34.1	33.3	33.7	36.6	26.5	30.6	14.6	21.1	18.4	14.6	19.3	17.3
2	44.4	26.6	35.1	28.4	22.8	25.6	16.0	22.8	19.5	11.1	27.8	19.5
3	11.8	35.3	19.6	44.1	23.5	37.3	23.5	29.4	25.5	20.6	11.8	17.6
4	39.0	31.2	34.6	30.5	28.6	29.4	22.1	14.3	17.6	8.5	26.0	18.4
5	30.6	38.6	33.8	38.8	30.0	35.2	16.5	14.0	15.5	14.1	17.5	15.5
Medians	35.5	34.9	34.6	29.6	28.2	29.4	17.6	21.0	18.4	14.4	17.5	17.3
*Indiana	36.1	33.9	35.0	26.2	26.4	26.3	20.8	21.9	21.4	16.9	17.7	17.4
*United States	42.8	39.2	40.8	26.6	26.8	26.7	17.8	19.3	18.7	12.8	14.7	13.9

*Report of U. S. Commissioner of Education, 1914, Vol. II, p. 420.

TABLE 2.—PERCENTAGE OF ACCELERATION, RETARDATION, AND NORMALITY BY GROUPS

Group and School	STATUS												
	Accelerated				Retarded				Normal				Within one year Normal
	*Prom.	NonP.	Wdrl.	Total	Prom.	NonP.	Wdrl.	Total	Prom.	NonP.	Wdrl.	Total	Total
Group I													
1	45.7	12.0	30.9	40.0	36.4	78.0	69.3	44.4	17.9	10.0	4.9	15.6	72.4
2	14.8	26.3	3.7	14.3	58.8	52.6	79.4	62.3	23.1	21.0	18.5	23.0	70.0
3	56.7	17.9	14.3	49.0	28.6	64.3	78.6	35.8	14.6	17.9	7.1	14.5	76.2
4	60.1	21.6	42.9	53.8	21.6	56.8	28.6	27.1	18.2	21.6	28.6	19.0	90.7
GroupII													
1	57.0	60.0	66.7	53.1	19.4	57.1	0.0	21.3	23.9	42.8	33.3	25.5	86.8
2	39.2	50.0	30.0	38.7	31.5	0.0	28.4	30.0	30.4	50.0	50.0	30.6	85.6
3	45.6	66.7	0.0	45.1	21.7	33.3	0.0	21.5	32.6	0.0	100.	33.3	76.5
4	37.6	0.0	0.0	32.4	43.6	81.8	87.5	49.3	18.8	22.2	12.5	18.4	75.8
5	37.9	50.0	33.3	37.3	26.5	25.0	83.3	28.8	34.7	25.0	16.7	33.8	89.4
Medians	45.6	21.6	30.0	40.0	28.6	56.8	69.3	30.0	23.1	21.6	16.7	23.0	76.5

*Prom. means promoted; Non-P., not promoted; Wdrl., withdrawal.

Table 1 should be read as follows: In school No. 1 of Group I, 31.5 per cent of all boys enrolled are in the ninth grade; 24.6 per cent of the girls; and 27.6 per cent of all pupils.

Table 2 should be read thus: In school No. 1 of Group I, 45.7 per cent of promoted pupils are accelerates; 12 per cent of non-promoted pupils are accelerates; 30 per cent of withdrawals; and 40 per cent of all pupils. 36.4 per cent of promoted pupils are retarded; 78 per cent of non-promoted pupils are retarded, etc.

Table 1 indicates that the median for these nine schools is approximately the same as that for Indiana as a whole. The distribution of pupils in Indiana schools is more satisfactory than in high schools of the United States in general in that the percentage is higher in the third and fourth years and lower in the first year, thus indicating a greater holding power. School No. 2 of Group I, which has apparently the poorest record of the nine, is undergoing a rapid growth in attendance (about 50 per cent in one year), which accounts for the large enrollment in the ninth grade and the low enrollment in the twelfth grade. Here it is not so much a rapid loss at the upper end of the course as it is a rapid growth at the lower end that causes the apparently poor showing. School No. 1 of Group I shows a remarkable holding power, which may in part be explained by the fact that it is in a college town.

The original data collected show the facts for each grade and for boys and girls separately with respect to acceleration and retardation. It should be mentioned that with almost no exception the girls have a higher per cent of acceleration and a lower per cent of retardation in every school and grade than the boys. This indicates that whether we have consciously designed it or not our schools are better adapted for securing the progress of the girls than of the boys. However, the status of the pupil in the high school may be entirely due to forces operating in the elementary school and not to the high school conditions at all. To determine the accelerating or retarding influence of the high school we should need the progress records of pupils in the high school.

An inspection of the data of Table 2 shows great variations between schools with respect to the same factor; for example, 14.8 per cent of the promoted pupils in school 2 of Group I are accelerates, and 58.8 per cent are retardates, while in school 4 of the same group 60.1 per cent of promoted pupils are accelerates and 21.6 per cent retardates. The median results indicate that

45.6 per cent of promoted pupils are accelerates and 28.6 per cent retardates. This record is much better than that usually found in the elementary school and is no doubt due to the fact that the majority of retardates have been eliminated on reaching years of voluntary attendance.

It will be noted that the non-promoted group has the lowest per cent of accelerates and the withdrawals the highest per cent of retardates. These data suggest a close relation between retardation and non-promotion and withdrawal.

The table shows that 40 per cent of all high school pupils are accelerates, 30 per cent are retardates, and 23 per cent are normal. A further computation of data indicates that 76.5 per cent of pupils are within one year of normal.

Per Cent of Failures in High Schools

Hubert G. Childs

At the same time as indicated above, blank forms were sent to the same schools asking for data relative to enrollments, repeaters, withdrawals, number remaining, failures, and promotions by subjects, to which the same schools responded and two additional, Nos. 5 and 6 of Group I, both of the 25,000 population city class.

In this report the group classification is the same as above, and medians have been computed for each group and for all eleven schools combined.

A portion of the data has been summarized in the accompanying tables under these heads: (1) per cent of failures by departments; (2) per cent of failures by years; (3) per cent of failures in certain first year subjects.

From each of these tables it will be observed that the per cent of failures is greater in every case in the schools of Group I. This may be accounted for in two ways: first, the close personal contact of patrons with the schools in the small communities leads to fewer failures as a means of avoiding friction and difficulty; and, second, the small size of classes and the close personal contact of pupil and teacher in these smaller schools should result in more individual stimulation and direction and fewer failures.

Every table shows a great excess of failures of boys as compared with girls in nearly all schools, grades, and subjects. Even in mathematics, supposedly a boy's subject, the girls surpass the boys in eight schools, equal them in one, and have a higher per cent of failures in but two schools (Table 1). In Table 2, the total median shows 11.1 per cent failure for boys, 5.5 for girls, and 8.5 for both combined. Table 3 shows that only about one-fourth as many girls as boys fail in first term algebra, one-half as many in first term botany, two-thirds as many in first term English, one-sixth as many in first term German, and one-third as many in first term Latin.

TABLE 1.—Per Cent of Failures by Departments (All Years)

Group and School	DEPARTMENT								
	English			Foreign Language			Mathematics		
	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	Total
Group I									
1	22.0	8.6	14.5	20.3	7.0	12.7	21.8	11.9	16.4
2	9.6	7.4	8.5	22.4	11.8	17.1	11.9	17.2	13.9
3	7.8	2.7	5.1	22.5	4.3	11.6	21.1	19.3	20.2
4	25.0	11.3	17.0	23.9	5.4	11.9	22.4	4.8	13.2
5	23.7	14.5	18.7	38.7	30.1	33.7	25.7	15.9	20.8
6	7.9	4.5	6.3	23.3	7.2	15.3	22.1	22.1	22.1
M	15.8	8.0	11.5	22.9	7.1	16.6	21.9	16.5	18.3
Group II									
1	15.4	0.0	6.3	42.4	11.7	23.8	20.0	0.0	9.6
2	5.1	1.3	3.2	23.3	6.2	15.3	14.5	6.9	10.6
3	0.0	0.0	0.0	4.5	0.0	2.8	23.0	9.9	18.1
4	9.6	5.6	7.3	13.5	5.6	8.5	13.0	6.7	9.9
5	7.5	5.6	6.7	5.7	0.0	3.0	8.6	10.0	9.2
M	7.5	1.3	6.3	13.5	5.6	8.5	14.5	6.9	9.9
Total Medians	9.6	5.6	6.7	22.5	6.2	12.7	21.1	10.0	13.9

TABLE 1—Continued.

	DEPARTMENT								
	Practical Arts			Natural Science			Social Science		
	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	Total
Group I									
1	7.3	9.1	8.1	11.4	3.9	6.3	19.0	7.6	11.6
2	3.8	6.4	5.3	13.8	6.4	9.6	9.6	2.2	5.9
3	4.9	0.0	2.5	22.2	0.0	9.8	24.5	6.7	15.0
4	9.6	3.2	6.6	19.0	7.4	12.5	18.7	1.0	8.8
5	9.8	8.3	8.9	16.8	16.3	16.7	10.7	14.2	12.9
6	8.8	3.3	4.4	8.8	0.8	5.1	2.5	2.2	2.3
M	8.0	4.8	6.0	15.3	5.1	9.7	14.7	4.5	10.2
Group II									
1	3.2	1.8	2.3	16.5	0.0	4.5	19.2	2.8	9.7
2	0.0	2.3	1.5	6.4	4.5	5.8	10.8	9.7	10.1
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	10.8	.3	9.4	5.4	7.4	6.6
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
M	0.0	0.0	0.0	6.4	0.0	4.5	5.4	2.8	6.6
Total Medians	3.8	2.3	2.5	11.4	3.9	6.3	10.7	2.8	8.8

TABLE 2. PER CENT OF FAILURES BY YEARS (ALL SUBJECTS)

GRADE

Group and School	IX			X			XI and XII			All*		
	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	Total
Group I												
1	16.9	10.1	13.1	30.7	13.2	20.6	14.5	2.7	7.3	16.2	8.2	11.6
2	16.1	11.9	14.2	10.5	13.1	11.6	16.8	0.0	8.3	11.1	8.2	9.7
3	16.1	9.6	12.2	25.9	14.4	19.3	12.6	2.9	7.8	12.1	5.5	9.6
4	32.2	10.0	17.1	19.8	2.3	10.3	15.7	4.3	10.0	19.9	5.9	12.0
5	40.1	22.8	32.2	12.6	19.7	16.7	10.1	13.5	12.3	22.3	16.3	19.0
6	22.3	11.5	17.2	13.4	18.8	16.2	3.5	1.5	2.7	9.8	6.9	8.5
M	19.6	11.7	15.7	16.6	13.8	16.5	13.6	2.8	8.0	14.1	7.5	10.7
Group II												
1	28.1	1.3	14.6	17.4	10.0	13.2	17.6	0.0	7.9	14.9	2.6	7.3
2	17.8	4.7	12.1	7.7	8.0	7.8	6.8	5.0	5.6	9.4	4.4	6.7
3	13.1	0.0	6.2	0.0	5.5	1.5	0.0	0.0	0.0	2.4	1.3	2.1
4	19.3	10.8	15.1	8.6	4.7	6.4	2.8	3.3	3.1	6.5	4.3	5.3
5	4.3	5.3	4.8	5.9	5.1	5.6	4.3	0.0	2.8	4.5	3.8	4.2
M	17.8	4.7	12.1	7.7	5.5	6.4	4.3	0.0	3.1	6.5	3.8	5.3
Total Medians	17.8	10.0	14.2	12.6	10.0	11.6	10.1	2.9	7.3	11.1	5.5	8.5

*Practical arts are included under *all*, but not under IX, X, XI and XII.

TABLE 3. PER CENT OF FAILURES IN CERTAIN FIRST YEAR SUBJECTS

SUBJECTS

Group and School	Algebra IB			Botany IB			English IB			German IB			Latin IB		
	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	Total
Group I															
1	14.6	16.2	15.4	0.0	7.7	5.3	9.3	8.3	8.9	13.8	9.4	11.5	33.3	0.0	13.3
2	4.5	5.0	4.8	35.7	11.4	18.4	7.6	3.3	5.6	19.5	10.0	11.3	39.2	16.2	25.4
3	32.1	24.3	27.7	...	...	...	3.1	2.8	2.9	22.6	3.6	13.6	21.4	8.3	13.2
4	25.0	6.4	12.5	0.0	11.1	10.7	39.3	14.5	22.9	42.1	10.7	23.4	23.5	8.1	12.9
5	36.7	0.0	19.4	27.6	0.0	25.0	35.3	19.5	26.7	59.0	43.6	51.3	39.1	31.0	34.8
6	31.0	20.5	26.3	30.8	2.1	8.2	11.0	6.0	8.0	33.3	2.8	22.2	41.7	13.0	27.7
M	28.0	11.3	17.4	27.6	7.7	10.7	10.2	7.1	8.5	28.0	9.7	17.9	36.3	10.7	19.3
Group II															
1	35.7	0.0	15.1	0.0	0.0	0.0	23.0	0.0	9.6	50.0	0.0	30.4	100.	8.3	15.3
2	18.5	8.1	12.5	7.1	7.6	7.4	8.5	0.0	5.8	35.7	0.0	20.8	26.7	9.1	19.2
3	50.0	0.0	20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.5	0.0	6.7
4	20.0	9.5	14.6	21.1	13.6	17.1	16.3	13.0	14.6	17.6	12.0	14.3	22.2	9.1	15.0
5	5.6	6.2	5.9	...	...	...	5.7	12.5	8.6	6.2	0.0	4.0	0.0	0.0	0.0
M	20.0	6.2	14.6	3.6	3.8	3.7	8.5	0.0	8.6	17.6	0.0	14.3	22.2	8.3	15.0
Total Medians	25.0	6.4	15.1	7.1	7.6	8.2	9.3	6.0	8.6	22.6	3.6	14.3	26.7	8.3	15.0

Table 1 should be read as follows: 22 per cent of the boys, 8.6 per cent of the girls, and 14.5 per cent of both fail in English in School No. 1. Other tables are to be read similarly.

Every table shows a wide variation among different schools when compared with respect to failures by years or subjects. For example, Table 1 shows a range in Group I of 5.1 per cent to 18.7 per cent failures in English; 11.6 per cent to 33.7 per cent in foreign language; 13.2 per cent to 22.1 per cent in mathematics; 2.5 per cent to 8.9 per cent in practical arts; 5.1 per cent to 16.7 per cent in natural science; and 2.3 per cent to 15 per cent in the social sciences.

Table 2 for Group I shows a range from 12.2 per cent to 32.2 per cent for ninth grade failures; 10.3 per cent to 20.6 per cent in the tenth grade; 2.7 per cent to 12.3 per cent in the eleventh and twelfth grades; and 8.5 per cent to 19 per cent for all combined. Even greater variations are apparent between schools for failures in first term subjects. School 5 of Group I has a very high failure rate, 19 per cent for all subjects and years combined (Table 3), while school 3 of Group II has an exceedingly low rate, 2.1 per cent. School 5 of Group I reported a 59 per cent failure rate in first term German for boys and 51.3 per cent for boys and girls together. It would appear that the standards of this school would result in the elimination of many pupils. Census and enrollment data show this school to have a smaller per cent of its population in high school than any city of its class reporting for this study.

An inspection of the table shows that a wide variation also exists with respect to failures by subjects. Table 1 for Group I shows a range from 6 per cent for practical arts to 18.3 per cent for mathematics. This indicates that all subjects have not been equally well organized and standardized. Mathematics and the languages are responsible for a very large per cent of failures, in some cases including more than 50 per cent of all pupils, while in some schools all pupils are passed in practical arts and the special subjects. Here the time element seems to be the only requirement for passing. One sometimes becomes suspicious of the reasons given for the popularity of these courses.

In all respects in which these data have been compared, lack of fixed norms or standards is apparent. It is hoped that this summary, while not based upon extensive data, may be suggestive for comparative purposes.

Observations on the Teaching of First Term Algebra

James Z. A. McCaughan, of the Bloomington High School

This experiment was undertaken at the beginning of the first semester of the present school year. It was proposed to treat three sections of beginning algebra pupils under the same teacher by the three plans outlined below and to make comparison of results. The scheme was to be carried out in several high schools in the State, but seems to have failed of execution in other schools.

Section one. Pupils of this section were to have the ordinary plan of recitation and were to study when they pleased and as much as they pleased.

Section two. Pupils of this section were to have a divided recitation. About fifteen minutes of the time was to be devoted to general and personal instruction and the rest of the period to the ordinary testing out of the pupils' preparation of the lesson. These pupils were to study but one recitation period daily and that in the school study room. Altho there was an attempt made, the instructor found himself unable to control definitely and regularly the division of time in the recitation.

Section three. These pupils had the ordinary recitation and studied the period following under the supervision of the teacher. They were to have no other study time.

Section one recited at 1:00 p.m.; section two, at 1:45; section three, at 2:30. This made the study period for section three last from 3:15 to 4:00, the most unfavorable period of the day.

Previous to the division of these pupils into sections there was no attempt to classify them according to their record in arithmetic. The data on this point, given later in this report, were obtained after the close of the semester in algebra. With the purpose of making it easy to get the final arithmetic grades, pupils from the city schools were taken as far as possible for these sections. These pupils seemed to be representative of the ordinary eighth grade graduates, with the exception of one member of section three, who never made a passing grade in 8B arithmetic, and for whom a great amount of personal help seemed to do little good.

The grades of the repeaters in the three sections are such as to have no effect on the figures for the final results.

TABLE 1.—COMPARISON OF ALGEBRA SECTIONS

Sec. I recited at 1:00 p.m.; no limitations on study time
Sec. II recited at 1:45 p.m.; study time limited to one school period daily.
Sec. III recited at 2:45 p.m.; study period, 3:20-4:00 supervised.

Column	1	2	3	4	5	6								7	8	9	10	11	12	13
SECTIONS	Enrollment	Withdrawn	Present during whole term	Number rural school graduates	Number repeating first term Algebra	Ranking of pupils in final Arithmetic and Algebra grades								Medians of final Arithmetic grades	Medials of final Algebra grades	Average number of minutes of daily study	Number passing	Percent passing	Number not passing	Percent passing after making up conditions
						90–100		85–89		80–84		75–79								
						Arithmetic	Algebra	Arithmetic	Algebra	Arithmetic	Algebra	Arithmetic	Algebra							
Sec. I	27	3	24	8	1	7	7	6	7	6	2	5	2	85.5	86.3	39.1	18	75.	6	83.3
Sec. II	26	2	24	1	1	1	10	3	1	9	5	11	3	80.5	84.3	33.4	20	83.3	4	83.3
Sec. III	26	3	23	0	3	3	8	3	6	7	4	10	3	81.	86.	36.8	21	92.3	2	91.3
Total						11	25	12	14	22	11	26	8							

TABLE 2.—STANDING OF THESE SECTIONS AS DETERMINED BY THE INDIANA UNIVERSITY SCHOOL OF EDUCATION ALGEBRA TESTS

TESTS	MEDIAN OF ATTEMPT			MEDIAN OF RIGHTS			PERCENT OF ACCURACY		
	Sec. I	Sec. II	Sec. III	Sec. I	Sec. II	Sec. III	Sec. I	Sec. II	Sec. III
1. Subtraction.	7.8	7.2	8.75	4.8	6.2	7.	61.5	86.1	80.
2. Multiplication from ( )	8.1	7.7	7.7	6.9	7.	7.3	85.2	90.9	93.5
3. One-process equations	10.25	10.4	8.9	6.5	7.7	7.5	63.4	74.	84.3
4. Division	4.8	4.8	4.9	2.4	2.1	2.25	50.	43.7	45.9
5. Transposing terms....	4.5	4.2	4.4	3.5	3.2	3.7	77.8	76.1	84.1
6. Collecting terms.	6.5	6.4	7.	3.9	4.6	5	60	71.8	71.4
7. Forming equations...	6.9	6.8	6.1	5.1	5.3	4.9	73.9	77.7	80.3

A study of Tables 1 and 2 shows that section three excelled in almost all points of comparison. This might be expected where the size of classes was practically the same. This suggests that a better plan for making comparison of results would be to take 50 pupils in one section with a period of supervised study and compare the outcome with two sections of 25 pupils each without supervised study.

In the light of this experiment, does the double period with supervised study pay? If we consider the cost of instruction, we would say that it cost twice as much to accomplish a passing grade for 21 pupils in one section as it did for 20 pupils in each of two other sections. Against this is to be placed a small but clear gain in efficiency percentage, and a clear gain in number of pupils passed. The percentage of gain in number passing indicates that 7 or 8 of the 10 not passing in sections one and two might have been saved by supervised study.

Does supervised study pull up the weaker pupils and pull down the stronger? The number of pupils is too small in this experiment to warrant any assertion in answer to this question. Those who think that supervised study has a tendency to pull down the brighter pupils may get some indication favorable to their opinion by a study of the number in the highest rank of section 2 (column 6, Table 1) in connection with their number of minutes of daily study (column 9, Table 1).

The use of the Indiana University School of Education Algebra Tests (see Table 2) gives a means of comparing these sections in important details of their work. This table brings out clearly the strong places and the weak. All sections are strong in subtraction and weak in division, the operation in which we would expect the subtraction ability to help in producing better results. The fact that the "tests" tell the same story in favor of section 3 as do other modes of comparison tends to show that they are reliable as measures of the pupils' progress and as a means of comparing classes and schools.

In these days we are making great plans for predicting a pupil's course of study by what he has already done. Suppose that these pupils had been sectioned for algebra on the basis of their final grades in arithmetic. Columns 5, 6, 7, Table 1, show in one way how much mistaken we might have been. Only 25 per cent of the lowest one-third of algebra pupils would have been properly classified; 19 per cent of the middle one-third, and 52 per cent of the highest one-third.

TABLE 3.—FINAL ARITHMETIC GRADES

	Lowest Third	Middle Third	Highest Third
Number of pupils	25	26	21
Per cent staying in the same third in algebra	25	19.2	52.4
Per cent moving to a higher third in algebra	41.7	57.7	
Per cent moving to a lower third in algebra	*33.3	23.1	47.6

*Pupils not passing in algebra.

Of the 12 failures in algebra, 2 were from the middle third in arithmetic; 10 from the lowest third. Of the 12 highest in algebra, 1 came from the lowest third; 7 from the middle third; and 4 from the highest third.

The Pearson's coefficient of correlation of final arithmetic and final first term algebra grades is +.458.

These comparisons seem to afford little encouragement for prophesying what a pupil may do. Cold figures take no account of the effect of increased age and development, new environment, new resolutions, and new motives for effort.

The Measurement of Reading in Indiana Schools (Abstract)

Melvin E. Haggerty, Professor of Educational Psychology, University of Minnesota.

The Thorndike reading tests were given in more than a score of Indiana cities in May, 1915. The results of these tests were sent to Indiana University and were there tabulated and comparative scores were made out. Additional tests were given in about twenty-five cities in December, 1915. These additional tests were given with a view to extending the original scales, making them serviceable over a wider area, and for purposes of re-examination after practice. The results of these tests show wide variations in reading ability in each of the several grades and among the classes of the same grade in the several cities. A complete report covering individual, class, and school scores for the several periods, the relations of sex, age, and time to the efficiency in reading, and a considerable amount of material on the extension of the scales is in preparation and should be available within a short time.

APPENDIX

Appendix

⁂This appendix belongs to the paper of Mr. B. R. Buckingham, p. 49.

MARCH TEST IN ARITHMETIC

1. If a map 10 inches wide and 16 inches long is made on a scale of 50 miles to the inch, what is the area in square miles that the map represents?

2. Cream is sold in half-pint bottles. If a milkman buys it at $1.20 a gallon and it costs 40 cents a gallon to bottle and deliver it, at what price per bottle must it be sold to gain 20 per cent?

3. A fruit dealer bought 300 apples at the rate of 5 for a cent, and 300 at 4 for a cent. He sold them all at the rate of 8 for 5 cents. What did he gain on the investment?

4. A family used 1½ bu. of potatoes a month. How much will be saved each month by buying them at $1.30 a bushel instead of at 8 cents a quart? (8 qts. = 1 pk.; 4 pks. = 1 bu.)

5. James buys papers at 10 for 6 cents and sells them at 1 cent each. If his sales average 100 a day for 6 days, what does he add to the family income after keeping $0.10 for himself?

6. The 7A class has 42 on roll and only 3 absent today; and the 7B class has 48 on roll with 4 absent. Which has the better percent of attendance and how much?

7. Bought pencils at $1.20 per gross, and sold them at 1 cent each. Find the gain per cent.

8. A family pays $25 a month for a non-heated flat and uses 5 tons of coal at $7 per ton for heating purposes during the winter. If they moved to a steam-heated flat at $30 a month, would they increase their expenses for the year or not, and how much?

9. The value of the men's factory products in the leading centers of the United States was as follows:

	1860	1900
New York	$17,011,370	$103,220,201
Baltimore	3,124,342	17,290,825
Boston	4,567,749	8,601,431
Chicago	540,709	36,094,310
Philadelphia	9,962,800	18,802,637

Find the increase or decrease in the value of the men's factory products in 1900 as compared with that of 1860.

10. Two boys made a gallon of lemonade, using 16 lemons at 30 cents a dozen and 2 pounds of sugar at 6 cents a pound. They sold it at 5 cents a glass, 6 glasses to a quart. How much was each boy's share of the gain?

JUNE TEST IN ARITHMETIC

1. A farmer has a herd of 12 dairy cows that average 22 pounds each of milk per day. The milk contains 3.8 per cent butter fat, and butter fat is worth 28 cents per pound. What is the daily income from the herd?

2. I am making a handkerchief out of a piece of linen 10$\frac{3}{8}$ inches square. If I make a $\frac{1}{4}$-inch hem all around it, how long and wide will it be when finished?

3. If Texas is 213.06 times as large as Rhode Island, and New York is 39.14 times as large as Rhode Island, then Texas is how many times as large as New York? Express to the nearest second decimal place.

4. According to the report of the Bureau of Census, the numbers of persons engaged in the different groups of occupations in the United States in 1880 and 1910 were as follows:

	1880	1910
Agricultural pursuits..........	7,713,875	12,567,925
Trade and transportation.....	1,871,503	7,605,730
Manufacturing pursuits.......	3,784,726	10,807,521
Professional services...........	603,202	1,825,127
Domestic and personal services	3,418,793	5,361,033

Find the total increase in the number of persons employed in the United States in 1910 over those employed in 1880.

5. A can of milk containing 40 quarts costs $1.60. What per cent is gained by selling the milk for 6 cents a quart?

6. I bought a cask of molasses containing 84 gallons for $28. Nine gallons having leaked out, at what price per gallon must I sell the remainder to gain $4.25?

7. A farmer's wife bought 2.75 yards of table linen at $0.87 a yard and 16 yards of flannel at $0.55 a yard. She paid in butter at $0.27 a pound. How many pounds of butter was she obliged to give?

8. A man and boy together spaded 9-10 of a garden. If the man spaded twice as much as the boy, what part of the garden did each spade?

9. A contractor completed $\frac{2}{5}$ of a job in 12$\frac{1}{2}$ days. How much longer should it take to finish the job?

10. In a certain state the cost of building a macadam road is shared by the town, county, and state. The state pays $\frac{1}{6}$, the county $\frac{1}{6}$, and the town the remainder. If the state pays $1,200, what does the town pay?

MARCH TEST IN GEOGRAPHY

1. In what country is Berlin?
2. What is the capital of New York State?
3. What is the chief export of Brazil?
4. In what state is Paterson?
5. Name a railway system connecting New York and Chicago.
6. Name a leading state of the United States in the production of cotton.
7. Name a city that is in North Latitude and also West Longitude.

8. Through what city does the Prime Meridian pass?
9. What changes are caused by the rotation of the earth on its axis?
10. In what state is Pike's Peak?
11. Name an important export from Buenos Aires.
12. Name the three most important countries of South America.
13. From what is latitude reckoned?
14. What state is next north of Illinois?
15. What is the latitude of New York City?
16. In what city is Harvard University?
17. Name a city that is in North Latitude and also in East Longitude.
18. Name the six great powers of Europe.
19. South of the equaeor in what direction do the trade winds blow?
20. Through what waters would you pass in going from the Black Sea to the Atlantic Ocean?

JUNE TEST IN GEOGRAPHY

1. In what country is London?
2. What is the capital of the United States?
3. Name the six continents.
4. In what state is Baltimore?
5. Name the five Great Lakes.
6. Name the two principal mountain systems of North America.
7. Name the zones into which the earth is divided.
8. What river forms a portion of the boundary between Europe and Asia?
9. What circles bound the Torrid Zone?
10. Name a leading state of the United States in the production of wheat.
11. For what industry is Pittsburg noted?
12. What changes are caused by the revolution of the earth?
13. Name an important city on the Danube River.
14. What state is south of Utah?
15. How many degrees of latitude are there between the North Pole and the South Pole?
16. Name an important city on the Clyde River.
17. Name the cardinal points.
18. Name three public buildings in Washington, D.C.
19. How many miles (about) are there in a degree of latitude?
20. Name a city that is in South Latitude and also in East Longitude.

MARCH TEST IN HISTORY

1. In what war was the battle of Gettysburg fought?
2. At about what time was the first message sent by telegraph?
3. Name three American generals in the Revolutionary War.
4. What were two important problems facing the United States government during Jackson's administration?

5. State one important general plan carried out by the navy of the North in the Civil War.
6. Mention two of the principal weaknesses of the government under the Articles of Confederation.
7. Under whose administration was the Civil Service Commission established?
8. Of what political party was Alexander Hamilton a leader?
9. What problem gave rise to the Free Soil Party?
10. In general, what was the attitude of England towards the South during the Civil War?
11. What is the provision of the Constitution regarding the number of members in the Senate?
12. To what political party in England did most of the settlers of Virginia belong?
13. What conclusion should be drawn from the following statements:
    (a) The farms of New England paid poorly in 1800.
    (b) The New England streams furnished plenty of water power in 1800.
    (c) During the 50 years preceding 1800, new machines were invented that made manufacturing much more rapid and profitable and these could be operated by water power.

JUNE TEST IN HISTORY

1. Give the name of the treaty made as a result of the Revolutionary War.
2. When was the cotton gin invented?
3. What colony in America was founded by English Catholics?
4. In what year did government under the Constitution of the United States begin?
5. What is the main purpose of the Monroe Doctrine?
6. To what section of the United States did the Ordinance of 1787 apply?
7. In the Civil War the North was fighting to establish a great constitutional principle. What was that principle?
8. What condition in England led to the settlement of Georgia?
9. From what part of Europe did the great majority of immigrants come before the Civil War?
10. To what religious body did most of the settlers of Pennsylvania belong?
11. Give the substance of one amendment of the Constitution made as a result of the Civil War.
12. What critical problem arose during Buchanan's administration?
13. What conclusion may be drawn from the following statements:
    (a) In 1880 the manufactured products of the South were valued at $500,000,000, or one-eleventh of the total for the whole United States.
    (b) In 1900 they had risen to $1,500,000,000, or one-ninth of the totals for the whole United States.
    (c) In 1905 they were valued at $2,200,000,000, or one-seventh of the total for the whole United States.

MARCH TEST IN GRAMMAR

Seventh Grade—First Half

1. Give the part of speech and the syntax of the underlined word in the following sentence:

   Certain birds nest in the vicinity of our houses.
2. Give an example, in a sentence, of a predicate nominative, and underline it.
3. Draw one line under the complete subject and two lines under the complete predicate in the following sentence:

   Down through the green leaves the sun was pouring his splendor.
4. Analyze: Now swiftly glides the bonny boat.
5. Write a sentence containing a relative pronoun in the objective case, and underline the word.
6. In the following sentence, give the case of the underlined word and state how it is used in the sentence:

   I gave him a letter for my friend, the attorney.
7. Give an example, in a sentence, of the positive degree of the adverb better and underline it.
8. Draw a line under all the nouns in the following passage:

   In winter I get up at night
   And dress by yellow candlelight.
   In summer, quite the other way,
   I have to go to bed by day.
9. Pick out the phrase in the following sentence and tell what it modifies:

   The windows were white with frost.
10. Underline all the pronouns in the following:

    I tell you he is a selfish fellow, one whose only thought is of himself. Those who have anything to do with him are likely to regret it.

JUNE TEST IN GRAMMAR

Seventh Grade—First Half

1. Copy each underlined noun and write after it its number, gender, and case:

   Lafayette, the friend of Washington, was a French nobleman.
2. Use, in a sentence, a personal pronoun in the first person, plural number, objective case, and underline it.
3. How may an adjective clause be distinguished from an adverbial?
4. Underline the subject word once and the verb twice in the following sentence:

   The cold November rain is falling.
5. Write a sentence containing the comparative of ill, and underline the word.

6. Analyze:
    Ammonia is found in the sap of trees, and in the juices of all vegetables.
7. Write the feminine of lord, earl, tiger.
8. Make the necessary correction in the following sentence:
    I am sure it could not have been them.
9. Give an example, in a sentence, of an adverb of time, and underline it.
10. Write a sentence containing a noun phrase, and underline the phrase

MARCH TEST IN GRAMMAR

SECOND HALF OF SEVENTH GRADE TO SECOND HALF OF EIGHTH GRADE

1. Analyze the following sentence:
    Columbus did not know that he had discovered a new continent.
2. Make a list of the verbs in the following sentences and after each verb write its mode, voice, and tense:
    Cassius, be not deceived.
3. Death will certainly knock at every door.
4. The territory claimed by the English had been called New Netherland.
5. Write the principal parts of *sweep*, *drive*, *write*. In each of the following sentences select the subordinate clauses and tell the syntax (use in the sentence) of each:
6. Books were written that they might give pleasure.
7. I was reminded of those days when I had known neither care nor sorrow.
8. The children played that they were keeping house.
9. Write a sentence containing a relative pronoun in the objective case, and underline the word.
10. In the following sentence give the case of the underlined word and state how it is used in the sentence:
    I gave him a letter for my friend, the attorney.
11. Give an example, in a sentence, of the positive degree of the adverb better and underline it.
12. Draw a line under all the nouns in the following passage:
    In winter I get up at night
    And dress by yellow candlelight.
    In summer, quite the other way,
    I have to go to bed by day.
13. Pick out the phrase in the following sentence and tell what it modifies:
    The windows were white with frost.
14. Underline all the pronouns in the following:
    I tell you he is a selfish fellow, one whose only thought is of himself. Those who have anything to do with him are likely to regret it

JUNE TEST IN GRAMMAR

SECOND HALF OF SEVENTH GRADE TO SECOND HALF OF EIGHTH GRADE

1. Copy each underlined noun and write after it its number, gender, and case:

   Break, break, break!
   On thy cold gray stones, Oh, sea.

2. Pick out the verb in the following sentence and after it write its mode, voice, and tense:

   A shower has been brought on by the mild summer breeze.

3. Give an example in a sentence of a participle used as a noun and underline it.
4. Give an example in a sentence of an infinitive in the passive voice.
5. Write a sentence illustrating the use of few as an adjective pronoun (indefinite pronoun).
6. Give an example in a sentence of that used as a conjunction, and underline it.
7. Combine the following statements into a complex sentence containing but one subordinate clause:

   In May a sparrow built its nest. The sparrow had evidently met with disaster earlier in the season. It built its nest in a mass of woodbine. The mass was thick. The woodbine was near my window.

8. Write the first person, singular, of the following:

   Passive voice, indicative mode, present tense of the verb "lead".

9. Write a sentence containing the comparative of ill, and underline the word.
10. Change the following complex sentence into a simple sentence without altering its meaning:

    We saw that it was wise to give in.

11. Write the feminine of lord, earl, tiger.
12. Make the necessary correction in the following sentence:

    I am sure it could not have been them.

13. Give an example in a sentence of an adverb of time, and underline it.
14. Write a sentence containing a noun phrase, and underline the phrase.

PER CENT OF PUPILS ANSWERING EACH QUESTION CORRECTLY, 7TH AND 8TH GRADES COMBINED

Questions	Arithmetic		Geography		History		Grammar			
							7^1		$7^1\ 8^2$	
	March	June	March	June	March	June	March	June	March	June
1	20.0	33.6	97.5	98.9	93.9	85.1	13.7	33.5	23.9	63.9
2	39.5	16.1	94.0	96.4	61.1	90.1	46.6	42.8	9.7	34.3
3	60.0	65.7	77.7	88.8	50.3	58.9	46.5	44.3	30.0	61.5
4	50.7	78.2	88.3	88.4	15.3	65.6	36.8	62.3	12.6	19.9
5	52.3	80.8	67.1	82.4	54.9	43.1	18.9	34.3	45.9	55.0
6	40.2	45.2	66.3	88.3	35.9	50.5	17.0	7.3	27.9	57.9
7	68.1	65.7	75.6	77.9	13.9	32.9	6.3	7.4	25.9	12.0
8	46.6	55.3	71.8	61.9	31.0	32.3	23.3	20.4	32.3	9.0
9	57.9	45.4	60.2	64.7	19.7	15.3	29.9	61.1	25.3	44.4
10	51.9	49.6	60.2	65.2	64.8	79.7	11.3	25.0	28.6	3.9
11			38.8	42.4	42.8	67.1			6.7	19.8
12			68.6	43.0	14.1	26.6			36.7	33.9
13			55.1	53.4					38.6	65.8
14			26.7	39.7					22.0	46.1
15			38.4	51.0						
16			24.2	48.3						
17			35.3	34.9						
18			43.3	24.1						
19			7.8	19.2						
20			12.8	28.4						

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†Proceedings of a Conference (Second) on Educational Measurements (1915). 50 cents.
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Public Discussion: State High School Discussion League (Municipal Home Rule), (1915-16).
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History Teaching in the Secondary Schools: A Conference held at Gary, Ind. (Out of print.)
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Lantern Slides: Rules for Borrowing, Catalog, and Suggestions for Use.
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